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AMERICAN POTASH INSTITUTE, INC.
INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*
Editorial Office: Investment Bldg., Washington, D. C.

VOLUME XXII NUMBER FOUR

TABLE OF CONTENTS, APRIL 1938

Vernal Visions 3
Jeff Exudes Spring Optimism

Profitable Cows Need Productive Pasture 6
Delmar S. Fink Substantiates His Points

Mississippi Soil Types and Their Preferences 10
Discussed by Stanton W. Davis

Corn on Alkali Soils Responds to Potash 13
B. M. Kilpatrick Presents the Evidence

New Approaches to Potash Fertilization 17
J. B. Hester Outlines Some New Problems

Mr. Pender Specializes in Asparagus 20
With Increasing Success, Says John Miley

Editorials 27

Reviews 29

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TEMPERAMENTAL APRIL.

Better Crops with PLANT FOOD

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VOL. XXII WASHINGTON, D. C., APRIL 1938 No. 4

Hope and courage spring anew in—

Vernal Visions

Jeff McDermid

BECAUSE spring gives us middle-aged gentry a new lease on life, whether we deserve it or not, I know of no topic just now which we may freely discuss with less chance of violent disagreement. We might easily become overwrought on naval preparedness, government pump-priming, the proper application of fertilizer, or how much pruning the orchard requires, but it stands to reason we all dote on spring, with special emphasis on us who do our doting in northern latitudes.

Plenty of us old buzzards who have quarreled with winter weather are prone to forget that a little cold storage sometimes preserves a good article longer than one might expect to keep it in good shape for protracted hot spells. This applies to us even as it does to Grandpap Jim Fry of Claremont, North Dakota. The United Press claims he celebrated his ninety-eighth birthday consuming his wonted menu of salt pork and corn whisky, and he jigs and sings ballads for relaxation, weighs 190 pounds, and can snipe a squirrel at 50 paces with a 22 caliber rifle. His advanced age and strong stomach can apparently be laid to the longevity of his family and their extreme hardiness amid the alternating blizzards and hot chinook winds of the prairies. We doubt extremely that Florida or California can boast, like Grandpap Fry, of any sister who lived to be 117 or a mother who lin-

gered long enough to greet 120 happy spring revivals.

Most always we get our first hint of spring while we are snuggling abed some night in late March. Probably we have got callouses on our hands from shoveling snow and cracking icebergs at the back stoop, and blisters on our heels from clumping around in gummy overshoes; so when we heave in the coal and hoist ourselves onto the tick this March evening, nothing seems further away than Oregon and roses.

YET just as we are almost counting the last sheep over the fence and wishing wife's feet were warmer and her breathing less sonorous, we hear the slapping of rain drops above us. No, not the icy, bitter, sleety kind this time, but the gentle patter of a soft shower, borne on clouds driving up somewhere from Dixie, showing us that because we couldn't take that trailer trip to balmy Alabama, the good old South is going to share some of its great gifts with us up here among the busted water-pipes.

Down she comes, sloshing on the shingles and making you think of bull frogs, bare feet, and bittersweet, and soothing you to slumber with dreams of sunny trout brooks, pansy beds at the kitchen door, and corn on the cob.

Or maybe some night the spring rain stops and toward dawn you rouse up sleepily to hear something coming straight down out of the vast sky spaces, the ghostly call notes of the birds of passage, migrating wedge-shaped northward through the dusky void—the welcome flight of those wild geese whose return to your State is the signal for more happiness than any spring election ever promised or performed. And the morning after you put on the oatmeal a little sooner, give the kids a broader smile than usual, and tell them to look at the purple crocuses below the window, pushing up through ice-bound, sodden leaves.

Did you ever stop to think that as man or woman grows older and approaches the "sear and autumn leaf" and then finally stumbles regretfully into his winter period, that person (just like the winter itself) begins to long for spring as he never did in the summertime of life? And you can't blame it all on slow circulation and "rheumaticks" either.

I guess we all remember how Mother and Father looked forward to spring with a persistent expectancy that puzzled us young ones. We got along quite well pelting snow-balls and thawing out our toes. The rash wind blew roses in our cheeks and brought us running noses, but it seldom frayed our nerves or gave us any lasting impression of being imprisoned or bored. I can see Mother yet as she perused some magazine with descriptions of balmy climates where some more lucky neighbor dallied during the winter solstice. And Father would have gnashed his teeth (had there been any to gnash) when he got photos from Uncle Edgar showing that worthy relative mowing his lawn at Pasadena while we were treading ice paths to the barn each January morning.

MY FOLKS were both of old New England ancestry and had the rigor of northern climate bred into their marrow; but as the telling years advanced upon them, they hungered for some land of perpetual summer. I believe they would even have discounted flies and mosquitoes for a taste of some such surcease.

I am afraid their chief reliance during the short and murky days of winter proved to be the free collection of sales literature, with which lonely farm houses were bombarded by the postman. Those numerous and highly illuminated catalogs, resplendent in all the imagery of lithographic art, gave them hopes which low finances kept them from fully realizing—yet

in the darkened theater of my parents' lives their advent on our shelves was the real overture before the curtain rose to the chorus of spring song.

Seed and nursery catalogs, paint and fence bulletins, garden almanacs and

floral brochures, each accompanied by its pink and yellow order blanks and "guarantees"—these almost always started my folks on long mental excursions planning for the adornment of some favored nook or the replenishment of some barren spot—all in the zeal of humble, home-loving companionship. How we ever got along without soil-conserving committees, rural social planners, and bumptious interviewers in those days so long ago and far away is now a mystery to me. We waxed content on small picking and thanked our spring stars it was no worse.

I — sure you were called upon like me to seize a stub pencil and help Father figure out the cost items and the totals entailed in the completion of a horticultural mail-order. Then when it was hiked up toward eight or nine dollars, Father would regretfully scan the gaudy promises made for certain moon vines, wonder berries, and hybrid roses and close the list with a heaving sigh of painful self-denial. Mother would then add her mite for new double marigolds and variegated sweet peas, and the family was then ready to pay its annual tithe to its arboreal ambitions. The hens usually provided the petty cash for this delightful deal, and this fact probably gave them a proprietary right to scratch-time out of the flower beds afterwards.

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(*Turn to page* 46)

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(*Turn to page* 46)

Profitable Cows Need Productive Pasture

By Delmar S. Fink
Assistant Biologist, Agricultural Experiment Station, Orono, Maine

WHY is pasture improvement a topic of active discussion today? Fundamentally, because during past years we have overlooked the part played by pasture in a dairy-cow-breeding program. We have bred our cows to produce, annually, several thousand pounds more milk than they did under natural conditions. But we have not improved, either in quality or quantity, her natural feed, *pasture.*

The result—dairy farmers now know that feed on ordinary permanent pasture will not maintain the production of a 300-pound-butterfat-producing cow. The feed is not there in sufficient quantity, it is not good enough, it does not meet her requirements.

Coordinate Needs

We cannot expect permanent pasture, which has received no attention from man, to feed a cow that has been highly developed for milk production by man. Suppose we go back to nature. In the great woods of northwestern Maine there is little pasture, as we ordinarily think of pasture. There are, however, thousands of deer living in this great forest (annual kill by hunters 20,000, estimated population 106,000). They reproduce freely, travel miles for feed, grow fat, live long, and, incidentally, "remain very active." About the only time there is a deer-feed problem is when the snow is exceptionally deep. The story would be different, at least from the standpoint of feed requirements, if man were to breed the deer to produce 10,000 or 15,000 pounds of milk annually. Ordinary permanent pasture may be excellent deer-feeding grounds, but we are dealing with 1,000-pound cows producing many thousands of pounds of milk annually.

Pasture Is Cheap Feed

The place to produce cheap milk is on pasture. It does not take much time to fertilize a permanent pasture, and that is about all the labor involved to grow the crop. Compare this with growing corn for silage, and we find the cow doing from 85 to 95 per cent of the work. If pasture is abundant she is more than willing to do most of the work. There is little justification, in view of the fact that pasture of one kind or another can be made available during the entire growing season, to barn-feed hay and ensilage during the pasture period.

The dairyman, fully aware of the above, is ready and anxious to put into practice a sound pasture-improvement program.

For the optimum growth of any crop, pasture included, the soil must contain a rather definite amount of readily available plant-food elements. Soil fertility improvement is fundamental to pasture improvement on the average New England dairy farm.

The relation between permanent pasture productivity in Maine, as indicated by vegetation present, and soil

fertility, as indicated by the amount of available N, P, K, and Ca in the surface soil, is given in the table below.

A SURVEY OF SEVERAL HUNDREDS OF ACRES OF MAINE PERMANENT PASTURES SHOWING THE POUNDS OF AVAILABLE N, P, K, AND CA IN THE SURFACE SOIL AT VARIOUS LEVELS OF PRODUCTION. SOIL SAMPLES OBTAINED DURING MIDSUMMER.

Pasture rating	Per cent vegetation			Pounds available plant food			
	White clover	Grass	Weeds and bare ground	NO_3-N	P	K	Ca
Poor	4	37	59	0	0+	50—	1,000—
Medium good	21	58	21	6	25—	50+	1,000+
Good	37	54	9	20	25	100—	1,000+
Excellent	53	45	0.9	60	25+	150	2,000

Most of the permanent pastures in Maine would be rated poor. Nature has laid down a carpet of poverty grass, hawkweed, and daisies to protect, as best it can, these neglected grazing lands for posterity. If they were not grazed, nature would cover them with forest vegetation.

The hesitancy, on the part of the farmer, to fertilize these poor pastures may be due to a lack of understanding in regard to the part played by improved permanent pasture in a dairy-farm roughage program. Excellent permanent pasture in Maine will regularly furnish an abundance of green feed for the milking herd from about May 10 to July 10. Later, depending on rainfall, it may furnish about 30 more grazing days, giving a total of 90 days. In other words, of the entire 150-day pasture season in Maine, a highly productive permanent pasture can furnish only about 60 per cent of the season's pasturage. We have been in the habit of turning our cattle to pasture for the entire season.

At present there are from 1 to 3 or more acres per cow being devoted to permanent pasture on the average New England dairy farm. Maine's

Fig. 1—Good feed produced by the application of 600 lbs. of 5-8-7 potato fertilizer in the pasture of A. G. Johnson, Bangor, Maine. The net profit of the fertilized area exceeded the net profit of the unfertilized by $33.01 an acre. Four acres fertilized furnished 1,088 cow-days grazing compared with 1,029 on 7 acres unfertilized.

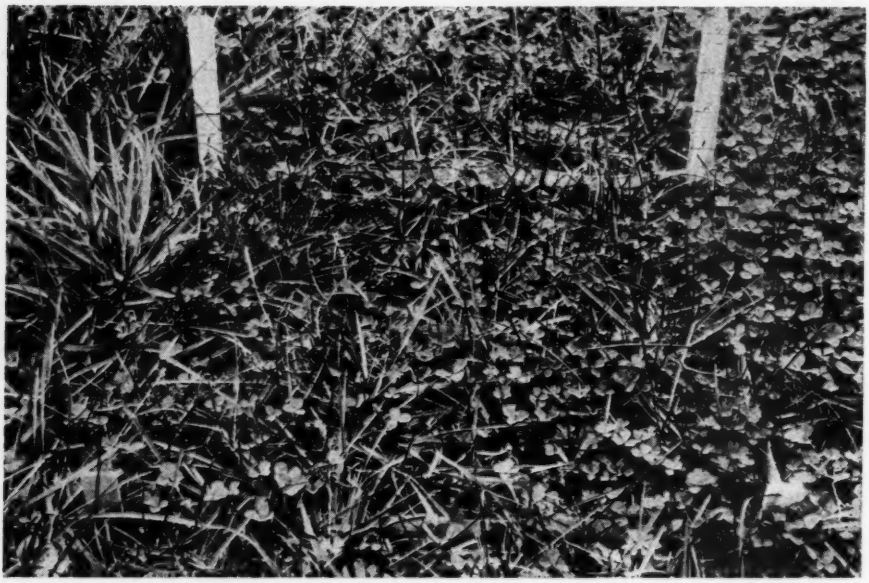


Fig. 2—Phosphorus alone applied at the rate of 120 lbs. per acre produced this scanty pasture growth.

approximately 150,000 head of dairy cattle roam over 1,500,000 acres in the course of one season. That all of this pasture need not and should not be improved is not fully appreciated by the dairy farmer. A productive permanent pasture will furnish at least 180 cow-pasture days per acre, or 75 to 100 per cent of the total feed requirements per cow per day, depending upon the cow's lactation period. Obviously, it must be grazed at two cows per acre, if it yields 180 cow-pasture days per acre and there are only 90 days during which the feed is suitable for the milking herd. There is little object in having more than one-half acre per cow. Improved permanent pasture is a crop, and as such should be distinguished from the wild-life sanctuaries we have been calling permanent pasture. We need a new word to distinguish improved permanent pasture from the millions of acres of rough, droughty, rocky, unproductive, truly forest land, which is referred to as pasture land.

In selecting land for permanent pasture improvement one should not overlook the fact that it will take less fertilizer, and therefore cost less, to build a real pasture on land which is in a fair state of fertility to start with. By all means, land devoted to permanent pasture must be at least medium heavy in texture; light, droughty soils are not suitable. We should select for improvement the best acres available, just as we select for herd improvement the best cows in the herd.

Season Program

On most dairy farms there is the possibility of devoting a portion of the crop land to pasture purposes. Dairymen are barn-feeding roughage during much of the pasture season in amounts almost equal to winter feeding. A sound, all-season, pasture program will lower barn roughage requirements. More adequate fertilization, particularly of the meadowland at the time of seeding down, and subsequently with annual top-dressings of fertilizer, will do very much towards meeting

Fig. 3—Application of 120 lbs. of phosphorus and 120 lbs. of potash produced lush pasturage.

the winter roughage requirements on fewer acres. In this connection it only need be mentioned that top-dressing meadows, 2 or more years old, with 50 pounds of nitrogen per acre, representing 250 to 300 pounds of a straight nitrogen fertilizer (depending upon its per cent nitrogen content), will regularly give 1,500 pounds to a ton more of better quality hay per acre.

If the proper acreage for improved permanent pasture has been located on the crop land of the farm, the fertilizer practice to follow should be determined from a chemical analysis of the soil. We know there is only one way to determine the worth of a cow and that is to weigh and test for butterfat the milk she produces; just so, the only way to determine quickly and accurately the productivity of a field is to test the soil for its available plant-food content. If a cow proves unproductive there is little we can do about it. She still has a real value, however, in that we can sell her for beef. If an acre of land proves unproductive it has little real value to anyone. We can, however, make it productive through adequate fertilization. A soil test, accompanied by recommendations of a soils specialist, will give accurately the procedure to follow.

Fertilizer Treatments

If the proper acreage, representing the best portion, of the old permanent pasture is to be used, a soil test is not so essential as the first step in improvement. The average Maine permanent pasture today does not have the inherent ability to furnish the necessary amounts of any of the major plant-food elements for reasonable production. The initial treatments, at least for the first 2 years, should be a generous top-dressing of complete fertilizer, for example, 500 pounds of an 8-16-16, or its approximate equivalent per acre. This is not a particularly heavy application of fertilizer. The standard 10-ton-per-acre farm manure treatment for crop land, the manure fortified with 30 pounds of 20 per cent superphosphate per ton, is about

(*Turn to page* 34)

Mississippi Soil Types And Their Preferences

By Stanton W. Davis
Assistant Extension Horticulturist, State College, Mississippi

FORTUNATELY or unfortunately, depending upon the angle from which viewed, nature was liberal with Mississippi when dispensing soils.

The United States contains 13 major soil divisions or areas, 6 regions, and 7 provinces. Of the 7 soil provinces of the whole country, 4 are found in this State. The Atlantic and Gulf Coastal Province is the largest, embracing the major part of the State. It is located, as its name indicates, along the Gulf Coast and extends up the eastern side of the State. The next or River Flood Plains Province takes in the delta soils along and adjacent to the river. The third or Loessal Province is located east of the River Flood Plains Province and immediately adjacent to it. This province is spoken of as Brown Loam Area and extends along the delta foothills. The fourth and last, the Limestone Valley Province, barely crept into the State in the northeastern part of Tishomingo County.

Each of these has definite characteristics, and contains a number of different soils. In fact, Dr. Clarence Dorman, an authority on Mississippi soils, has identified more than 150 soil types. These soils are often different in their composition, and thus present a complex problem to the farmer. It is not unusual for him to find several of these soil types on his cultivated acres. He, too, has noticed the difference in yield of the crops planted on the various soils. A recognition of this difference in yield causes a question to bob up. Does each of the different soils, he wonders, contain the essential plant foods in the same amounts? Is there a difference, he asks, in the kinds of plant foods most abundant in the sandy loam soils on the hill, the black heavy soil down in the creek bottom, and the poor-yielding field on the north forty that the county agent calls Susquehanna?

Adapt Soil to Crop

When he gets busy thinking on this problem he is naturally led to a kindred question: Am I proceeding wisely, he wonders, in presuming that one fertilizer, say a 4-8-4, is equally good for all crops and on all soils, or should these elements vary with different soils and crops? There must be a difference, he thinks, in the amount of plant food contained in the different soils or in the requirements of the various crops, for it is common knowledge that on most soils nitrogen stimulates plant growth, phosphorus hastens the ripening process, and cotton rust can be prevented by a liberal application of potash. These things being true, there must be a variation in the plant-food content of the different soils or else a difference in the fertilizer preference of certain crops. Either would mean the same to the farmer, financially, as it would necessitate increasing the deficient or preferred elements as the case might be.

With several different soils to identify on his farm, crops best suited to each to determine, and the plant-

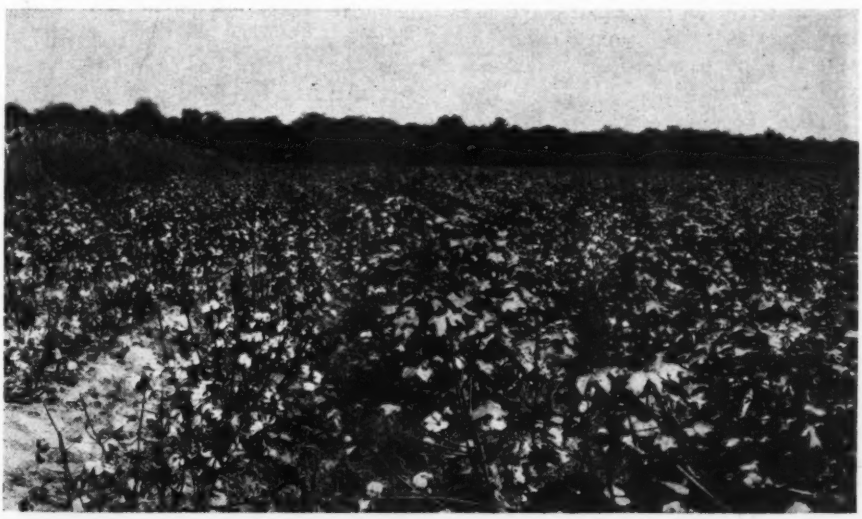
food availability to reckon with, is it any wonder that the farmer becomes perplexed, confused, confounded, and at last hopelessly "balled up"? Only by a careful study of the experiment stations' reports and by comparing their soil types with those on his farm is he able to proceed wisely in solving his production problems. For instance, the research workers at the Delta Experiment Station at Stoneville have found that most soils of the River Flood Plains Province are, for practically all crops, deficient only in nitrogen. That is unless the soil has been in cultivation for a long time. But just east of this area along the delta foothills in the Loessal Province there is a definite potash deficiency, as shown by the fact that cotton rust is common. These soils respond readily to potash.

For several years county agents have, with the cooperation of farmers in their counties, run various fertilizer tests, but in the spring of 1937 definite plans were made for determining the response of various soils to potash when applied to sweet potatoes and cotton. The county agents in 14 counties cooperated with 18 farmers in making potash tests on sweet potatoes. These 14 counties were distributed from one end of the State to the other and involved many different soil types. The applications of additional fertilizer were at the rate of 100, 200, 300, or 400 pounds of muriate of potash to the acre in addition to the regular application. The additional potash was added to a given area in the regular planting. All conditions as to time of planting, method of planting, spacing, and culture were identical with the remainder of the potato crop.

Sweet Potato Results

In production these soils ranged all the way from Susquehanna, which is described in "Soils of Mississippi" as "A poor soil, low agricultural value," to Red Bay, which is rated as one of the best hill soils.

The results obtained from the sweet potato tests were both enlightening and gratifying. They were gratifying in that they indicate the possibility of producing much heavier yields than are now being gotten, and enlighten-



Soils deficient in potash respond readily to high potash fertilizers. Left: 600 lbs. of 6-8-4 per acre (note the cotton rust). Right: 600 lbs. of 6-8-8 per acre.

ing because they indicate that a much higher application of potash is necessary on some soils, while they suggest that the addition of heavy applications of potash on other soils is useless expenditure of the farmer's money.

On the Susquehanna soil there was an actual decrease in the yield, while on all other soils a decided increase was registered, ranging from an increase of 133 bushels per acre down. The highest yield obtained from plots receiving the extra potash was 487 bushels per acre, and of the 14 farms completing the tests five made more than 300 bushels per acre where the extra potash was used. Not only was there a decided increase in the yield, but the percentage of No. I potatoes was higher than under the regular farm practice. The check plots averaged 63 per cent, while those receiving the additional potash averaged 73 per cent No. I's.

Results With Cotton

The county agents and vocational agriculture teachers in more than 20 counties cooperated with farmers in getting a check on the response of cotton to additional potash, under regular field practice. This was in addition to the fertilizer tests that have been run at the experiment stations for several years past and of which more will be said.

These cotton tests were made on many soil types and were no less illuminating than were the potato tests already discussed. The writer recalls vividly one demonstration that he saw. It was on Lufkin Silt Loam and on the same farm on which a potato test was made.

The potatoes in this particular test showed an increased yield of 77 bushels per acre. The check plot of cotton fertilized with 600 pounds of 6-12-6 made a yield of 840 pounds seed cotton per acre, while the adjoining plot fertilized with 600 pounds 6-8-8 produced 1,260 pounds per acre, or an increase of 420 pounds as a result of increasing the potash from 6 to 8 pounds per hundred pounds of fertilizer. (Naturally we assume that no increase resulted from decreasing the phosphorus from 12 to 8 pounds per hundred.) The check plot fertilized with 6-12-6 had many immature bolls and many bolls that had matured but only partly opened. All the foliage was dead long before frost, while the area fertilized with 6-8-8 had fully matured its bolls and stood loaded with green leaves when frost came.

A test conducted on Magnolia Silt Loam was no less responsive. In this the regular practice of applying 600 pounds of 4-8-4 gave a yield of 1,230 pounds per acre, but when the analysis was changed to 4-8-8 and the same amount used the yield was stepped up

(*Turn to page* 36)

TABLE I—ANALYSIS TEST—EAST MISSISSIPPI—SCOOBA—LUFKIN FINE SANDY LOAM

Treatment	Seed cotton per acre	Increase over no fertilizer	*Value of crop	Gain over no fertilizer	Cost of fertilizer	Profit over fertilizer
600# 4-8-4	954	400	$38.16	$16.00	$7.86	$8.14
600# 4-8-0	765	211	30.60	8.44	6.99	1.45
600# 4-8-8	1,116	562	44.64	22.48	8.70	13.78
600# 4-8-12	1,053	499	42.12	19.96	9.57	10.39
600# 0-8-4	765	211	30.60	8.44	5.58	2.86
600# 6-8-4	972	418	38.88	16.72	8.97	7.75
600# 8-8-4	959	405	38.36	16.20	10.11	6.09
600# 4-4-4	878	324	35.12	12.96	12.96	5.97
600# 4-12-4	1,075	521	43.00	20.84	20.84	12.14
600# 4-0-4	850	296	34.00	11.84	11.84	5.72
No fertilizer	554	...	22.16	....	....	....

* Value at 4c per pound for seed cotton.

Corn on Alkali Soils Responds to Potash

By B. M. Kilpatrick
Iowa State College, Ames, Iowa

APPLICATIONS of potash fertilizer on northern Iowa high-lime or so-called "alkali" soils have given profitable increases in both the quality and quantity of corn in demonstrations conducted during the past few years.

"Alkali" is the term used to designate soil areas where there are high concentrations of calcium carbonate or bicarbonate, and also other salts, deposited on the surface by evaporation of water as a result of draining of swamps, sloughs, lakes, and ponds left by glaciation in the Wisconsin and Iowa soil drift areas. Alkali occurs in thousands of acres of soils in northern Iowa and, according to estimates, is a more or less serious problem in some 40 counties in the northern section of the State, occurring most frequently in the Webster and Clyde soil series.

These alkali areas are commonly referred to by farmers as "hot." The areas vary in size from a few rods square, such as those found at the edge of a small pond that has been drained, to occasionally as much as several hundred acres. The highest concentration of salts is usually found at the edge of these ponds or depressed areas and may be noted by whitish deposits in the spring or summer. Some of these "hot" spots have shown an acid-neutralizing value as high as 40 per cent, 2½ tons of this soil having a neutralizing value equivalent to about 1 ton of good limestone. Of the essential plant food elements—nitrogen, phosphorus, and potassium—nitrogen seems to be highly available, phosphorus may or may not be highly available, and potassium is usually unavailable.

Fig. 1—Placement of potash fertilizer with side-dressing method. Applied after potash starvation symptoms appeared.

The high concentration of "alkali" salts seems to lock up the potash in an insoluble combination which plants, especially corn, cannot assimilate. Corn planted on these areas germinates, but soon after coming up begins to show marginal firing of the leaves. Many plants die, and those that live produce small, immature stalks with short internodes and small, chaffy, immature ears of low feeding value. Oats seem to grow better than corn, but usually develop scantily

Fig. 2—Clark Clement field, Garner, Iowa, June 1937. The four rows to the left received no fertilizer. The fifth row to the left and rows to the right received potash fertilizers applied with planter attachment.

filled heads and heavy straw that is likely to lodge badly.

Soon after these areas were drained, trial and error methods showed that heavy applications of strawy manure helped to correct the difficulty. Heavy applications of manure, however, supplied an excess of nitrogen for these spots, which were already high in nitrogen. When applications of manure were heavy enough to correct the difficulty, other parts of the farm were slighted.

Application Important

In 1925 some work was done on broadcast applications of muriate of potash in Hardin County with good results. Later some broadcast plots were established on "hot" alkali soils with varying rates of potash and phosphate applied separately and in combination. Good results were obtained the first year or so with potash when applied at heavy rates, but later on the potash which had been applied seemed to become as insoluble as the original potash in the soil. A few years later hill applications of potash fertilizers made with a planter attachment brought satisfactory results.

In 1935 after starvation symptoms had appeared, side-dressing applications on corn were made with a garden planter resembling a cultivator on a number of plots in the northern part of the State. The purpose of these tests was not to find a supplementary method of applying fertilizer, but to discover whether potash could be applied profitably to corn after symptoms of starvation appeared. With this machine potash was applied at a depth of 2½ to 3 inches—the approximate depth at which the fertilizer would be applied with the cultivator attachment—and as close to the row as possible. Figure 1 shows the placement of the fertilizer in side-dressing the corn plant. An average increase of 15 bushels per acre was obtained in 1935 on plots where potash was applied between June 10 and July 10. In 1936, a dry season, plots of the same type were again tried, using an early June and an early July application. Work on these plots gave an opportunity for increased attention to the study of potash deficiency symptoms on corn plants.

This work demonstrated that if potash deficiency symptoms are recognized early in the season and potash is

applied, a profitable crop can be grown on these soils. If the supply of available potash in the soil is very low, corn plants will show damage very early in the season. However, on some alkali soils having a small amount of available potash, the deficiency does not show up until later in the season. This was especially noticeable where farmers had used a fertilizer combination containing some potash but not enough to carry the plant through to maturity. The plant was normal and green when it started out, but as it became older it developed marginal firing of the leaves and at maturity a stunted stalk and ear.

occur were answered. On some of the plants 500 pounds to the acre were used with satisfactory returns and no detrimental results. On one plot in particular a row of corn was selected and muriate of potash applied as close to both sides of the row as possible at a rate of 500 pounds per acre. As a result the fertilized row produced strong, normal stalks and well-developed ears, while the unfertilized corn around it showed typical potash deficiency symptoms and very low yield.

Following is a summary of the 1936 results:

Average of 9 farms	Average net increase per acre above cost of potash
100 lb. 50% muriate of potash S. Dr. early June	$4.31
200 lb. 50% muriate of potash S. Dr. early June	4.60
100 lb. 50% muriate of potash S. Dr. early July	2.41
200 lb. 50% muriate of potash S. Dr. early July	.58

Muriate of potash figured at $2.28 per 100 pounds.
Corn values: Marketable corn at 90c and 45c for poor quality unmarketable.

In these tests the questions of how close to the row the application could be made and how much potash per acre could be used to side-dress the corn before injury to the plant might

Fertilizer demonstration plots conducted in 1937 were again of two types—(a) with cultivator attachment, (b) with planter attachment.

In the planter attachment plots the

Fig. 3—Clark Clement field, Aug. 3, 1937. Left: 120 lbs. of 0-9-27 applied with planter attachment. Center four rows, no fertilizer. Right: 120 lbs. 0-20-20. Fertilized rows, normal height and green color. No fertilizer, short, immature plants and marginal firing.

fertilizer comparisons varied according to the degree of alkalinity of the soils. For those conducted on the less alkaline soils, a combination of 0-20-0, 0-20-10, and 0-20-20 fertilizers at an approximate rate of 120 pounds was used. For those conducted on more alkaline areas, a combination of 0-20-10, 0-20-20, and 0-9-27 at the same rate was used. The season was very wet in this area at corn planting time. On the "hot" spots where the fertilizer was used, however, the corn came up quicker and grew faster. The corn that was unfertilized showed typical yellowing of the edges and tips of the leaves early in the season. Many hills on the unfertilized plots died early. Plants that survived on the unfertilized areas had typically stunted stalks, short internodes, and short, chaffy, immature ears of low feeding value.

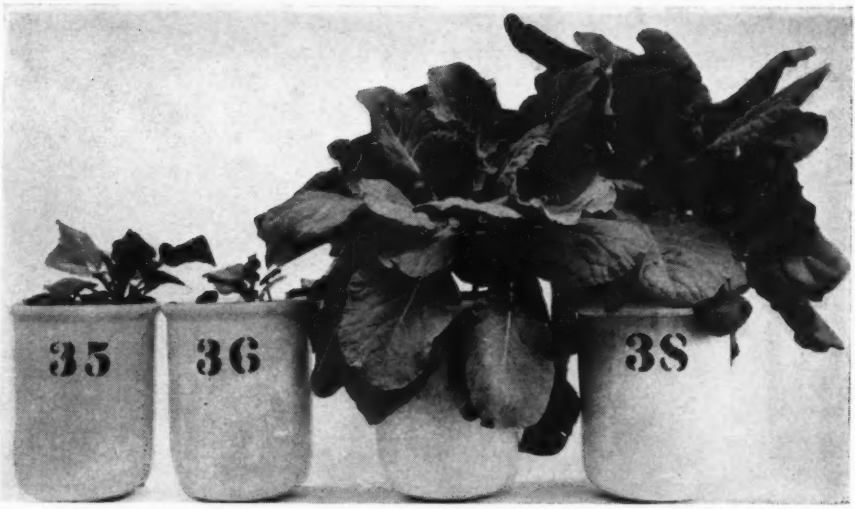
Several of the plots were checked with the farmers' combination of fertilizer, such as 0-12-12 or 0-14-14 applied at rates of approximately 75 to 100 pounds. It was quite noticeable that these combinations and the 0-20-10 did not contain enough potash to carry the plant through to maturity. These plots started off much better than those not fertilized and seemed to have enough potash until about the middle of July, when firing showed up on the lower leaves and in the tips and margins of the upper leaves. In contrast, all of the plants on plots treated with 0-20-20 and 0-9-27 remained normal and green.

Typical Demonstration

A typical planter attachment demonstration on "hot" alkali was located on the Clark Clement farm near Garner in Hancock County. This field of about 25 acres was quite alkaline, showing an acid-neutralizing value of 25 to 30 per cent over most of the field. Plots of 4 rows each of 0-20-10, 0-20-20, and 0-9-27 at a rate of approximately 120 pounds per acre were used with 4 unfertilized

(*Turn to page* 38)

Fig. 4—Ray Frye field, Dows, Iowa, Aug. 3, 1937. Left: no treatment. Right: 200 lbs. muriate of potash side-dressed June 8 with cultivator attachment after potash starvation symptoms had appeared.



1% organic matter 3% organic matter

Illustrating the influence of organic matter upon the crop-producing power of a Norfolk fine sand. Each pot received a complete fertilizer.

New Approaches to Potash Fertilization

By Jackson B. Hester

Formerly Soil Technologist at the Virginia Truck Experiment Station, now connected with the Campbell Soup Company, Camden, New Jersey

SO SERIOUS a question of potash exhaustion did not exist under the old system of agriculture where inhabitants practically lived on the farm and sold away no great quantity of material. Today large quantities of vegetable crops move into the great cities from the Coastal Plain section of the United States, and with these crops large quantities of potash move away from the soil.

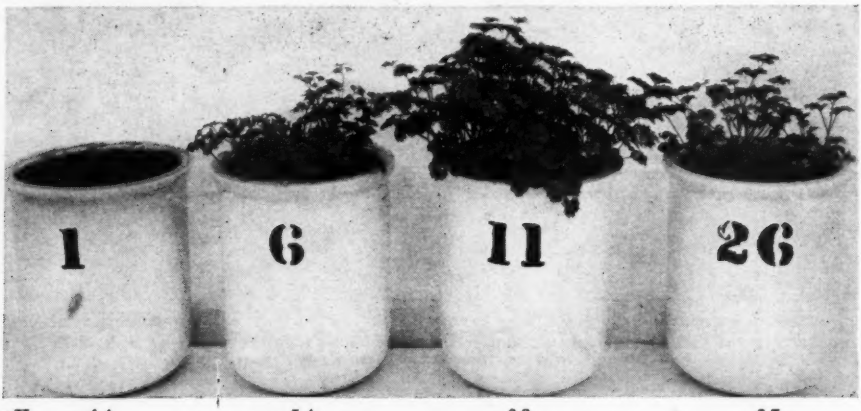
For example, with every 600 bushel baskets of spinach (acre yield) approximately 97 † pounds of K_2O are removed from the soil; for 600 bushel baskets of collards, 79 pounds per acre; for 525 bushel baskets of kale, 47 pounds. When it is considered that eastern Virginia alone sends away on an average each year 1,301,000 bushel baskets of spinach, 766,000 bushel baskets of kale, 26,000 tons of cabbage, 10,957,000 bushels of potatoes, 4,270,000 bushels of sweet potatoes and with them 8,383,000 ‡ pounds of K_2O, the potash fertilization of vegetable crops on Coastal Plain soils becomes an interesting problem.

This quantity of potash represents

† Calculated from analyses of crop grown on the station farm.

‡ Based on the estimated yield for the past 5 years.

83,830 tons of 6-6-5 fertilizer mixture and does not include leaching, fixation, and the utilization and removal by many other crops. The estimated usage of mixed fertilizer in the Norfolk section is 60,000 tons. Therefore, from the standpoint of fertilization, leaching as well as fixation in a difficultly available state must be considered and met, if the crop is going to be adequately fertilized with potash.



pH 4.4 5.4 6.2 6.7

Illustrating the crop-producing power of a Portsmouth loamy fine sand at various pH values. Each pot received a complete fertilizer.

Since this has been going on for a number of years it is evident that more potash is being removed from the soil than is being added.

From the standpoint of potash fertilization for vegetable crops, the 97 pounds of potash removed by spinach represents the equivalent of approximately a ton of 6-6-5 (N-P-K) fertilizer mixture. However, a 600-bushel yield of spinach is slightly more than the average yield for this crop in the Norfolk section but not the maximum, which brings up the discussion of potash fertilization and crop-producing power.

Nitrogen has often been referred to as the most elusive of the major plant nutrients. Perhaps second to nitrogen is potash, and from the standpoint of the leaching of the bases potash is, in many instances, second to calcium. Thus, potash is subject to leaching on Coastal Plain soils in rather large quantities. Potash also is subject to fixation by the soil colloid in a difficultly available state, to a degree perhaps second to magnesium.

Leaching and fixation are the unknown factors in the case, for it has been shown that if a soil is expected to produce 600 bushels of spinach it would be necessary to add only about 200 pounds of muriate of potash were it not for these factors. But since leaching and fixation are factors, and since these factors vary from soil to soil, a host of problems are presented. Some of these problems will be discussed in view of the present knowledge of potash research.

Maintain Potash Supply

The average Coastal Plain soil carries between 2,000 and 8,000 pounds of total potash per acre in the top 7 inches or plowed surface. This is far less than the quantity carried by many of the heavier types of soil in the United States. For instance, it is not uncommon for the heavier types of soil to analyze 2 per cent in total potash. This represents approximately 40,000 pounds per acre 6-inch basis.

When it is considered that approximately 5,000 pounds of K_2O repre-

sent the average total potash content in the plowed area of the Coastal Plain soils and that this has been subjected to 40 to 50 inches of rainfall each year for many years and has changed but little, not a great deal can be expected from the reserve supply. Consequently, the application of potash to the soil is of paramount importance. No one wishes to apply more potash than will prove profitable, but everyone is interested in applying the necessary quantity.

The common definition of a fertile soil is one that is producing or capable of producing fruitfully and abundantly. From inference it might be said that a soil is fertile from the standpoint of potash when it possesses sufficient potash in a readily available state to produce an abundant crop. That is apparently a very simple and adequate definition until one begins to look into the question of fertilization. What is the yardstick for measuring the quantity of potash to make a soil productive from the standpoint of potassium?

Infertility, on the whole, is easier to investigate than fertility, because it presents a specific problem. The question of investigating the infertility of a soil in respect to a given nutrient brings up the question of the crop-producing power of the soil. If a situation existed that gave a perfect condition for maximum production, space alone would be the ultimate limit of production. That is, all the plant material that could occupy the space of 1 acre would be the maximum production of that acre. The first limiting factor in the Coastal Plain section is likely to be the soil and the second the climate.

Maximum Producing Power

A soil has a certain maximum crop-producing power if given the proper climate. In order to investigate this problem a series of soils was brought to the greenhouse for investigation. The soil was screened and placed in 2-gallon earthenware crocks. It was used in its natural state, limed to produce various degrees of acidity, and was then fertilized uniformly with nitrogen, phosphorus, and potash, watered adequately, and planted to various crops. These data are given in Table 1, from which the maximum crop-producing power can be calculated for a given degree of acidity.

TABLE 1—THE RELATIVE CROP-PRODUCING POWER OF THREE SOIL TYPES

Beets		Strawberries		Spinach		Lima beans		Kale	
pH	Yield dry weight, grams	pH	Yield dry weight, grams	pH	Yield dry weight, grams	pH	Yield dry weight, grams	pH	Yield dry weight, grams
Portsmouth—13.5 per cent organic matter, 5 per cent clay									
4.0	0.1	4.0	1.3	4.0	0.1	3.9	11.2	4.1	0.02
6.2	13.3	5.9	9.6	5.8	6.1	6.7	41.2	6.3	9.7
Bladen—1.8 per cent organic matter, 12 per cent clay									
4.2	0.0	4.4	1.6	4.4	0.0	4.2	8.5	4.2	0.1
6.1	8.4	5.6	6.7	5.4	3.5	7.0	29.2	6.4	7.1
Norfolk—1.0 per cent organic matter, 5 per cent clay									
5.5	0.2	5.2	0.0	4.8	0.0	5.0	11.5	5.1	0.3
6.2	4.5	5.6	2.4	5.5	3.9	5.2	25.5	5.8	1.7

Take for instance the crop-producing power of the Portsmouth soil for beets: at pH 4.0 it is almost negligible, but at pH 6.2 it is 13.3 grams of dry matter per pot or about 15 tons of green weight per acre. Thus, if unfa-

(*Turn to page* 42)

Mr. Pender (right) and friends inspect a 5-year-old asparagus field.

Mr. Pender Specializes In Asparagus

By John Miley
Williston, South Carolina

HE MAY be called the "king with many crowns," as he sells more than 1,000,000 asparagus crowns annually. With such a record behind him, T. R. Pender, of Williston, S. C., might easily lay claim to the title of "largest asparagus-crown producer in the United States," or in the world for that matter. But growing "titles" does not interest him so much as his active work with the local Boy Scout troop and the operation of a general farm which produces cotton, corn, small grain, and watermelons, besides asparagus.

However, his work with asparagus is our chief concern here. A comparison of his results in the beginning with those at the present time tells its own story of progress. In 1917 Mr. Pender planted 2 acres to asparagus, using 25 pounds of seed to produce 40,000 marketable crowns per acre. Now he plants 40 or more acres every year with only 7 pounds of seed per acre and produces about 25,000 marketable crowns per acre. Where he used to pack 2,000 crowns in an average fertilizer sack (2-bushel size) to ship to market, he now puts 1,000 crowns in a beet pulp sack (7-bushel size) for shipping. This means that he is not only producing more asparagus with less seed, but he is getting larger crowns which bring a better price on the market.

It speaks well for the Mary Washington variety of seed that Mr. Pender has used this type of asparagus exclusively in his plantings. Now he sells his own seed—about 5,000 pounds annually—a large amount of which finds its way to California. He sells crowns in every asparagus-producing State in the Union, including the Hawaiian Islands, and has shipped to British Columbia, Montreal, Canada, and the Dominican Republic. However, Delaware, New Jersey, and Maryland buy the bulk of his crowns. Keenly interested in new developments, Mr. Pender became associated with the experiment in growing winter asparagus, which is being conducted at Belle Glade, Fla., and supplied the crowns for this test.

How does he cultivate his own asparagus? What methods and means has he employed to bring about such startling improvements over those 1917 results? In other words, what is the story behind his success? As is usually the case, simple and sound practices developed over a period of years and adjusted to the changing demands of the crop are the story.

Mr. Pender says that a good Marlboro sandly loam soil as free as possible from grass and weed seed and with subsoil 12 to 18 inches below the surface is an ideal soil for the production of crowns. Thorough preparation, breaking about 8 inches deep and harrowing until mellow, is necessary. About the middle of February open the rows with a 6-inch shovel, 36 inches apart, apply 600 pounds of a 5-7-7 (NPK) fertilizer per acre, and make a small ridge. About the last of February, in this section of the country, harrow the field and plant the seed, placing one seed to a hill about 1½ inches apart. Then cover with 2 inches of soil, or deeper if planting is done late in the spring. It will take about 7 pounds of large seed per acre.

Frequent Cultivation

Cultivation should be started when the seed are up to a good stand, and should be frequent to keep the topsoil loose and to kill weeds and grass. If grass or weeds are allowed to get among the plants, it has to be removed by hand, and then some of the asparagus plants will be destroyed. The last cultivation should be made the first part of September, and it should leave the plants on a small ridge about 3 or 4 inches above the level.

The first application of nitrate of soda, 30 to 40 pounds, should be made at the time of the second plowing. About 4 weeks later put out 60 to 70 pounds of soda. About the first of July apply 700 pounds of a 5-7-5 (NPK) fertilizer. A final application of fertilizer, 150 pounds of muriate of potash and 125 pounds of nitrate of soda, is spread about the middle of August.

In December and January the crowns are plowed up, graded,

This 90-day-old asparagus is carefully tended.

counted, and packed for shipment. Only the large, healthy crowns are worth planting, as asparagus is a perennial, and the crowns put out are expected to produce for several years. If the crowns are to be kept out of the soil for any length of time they should be stored in a dark, cool, dry place.

For setting out the crowns, Mr. Pender believes that a good, well-drained sandy loam soil with subsoil at least 12 inches deep will produce asparagus profitably, provided it receives good treatment. It is much easier and cheaper to plant asparagus crowns in fertile soil than to plant them in poor soil and try to build it up afterwards. The crowns should be planted during the dormant season, in this section it is usually done in February.

Prepare the soil thoroughly, with rows from 6 to 6½ feet wide. Open the rows about 10 inches deep, place the crowns (eyes turned up) in the bottom about 20 inches apart, and cover them with 2 inches of soil. Do not allow implements to run over or animals to walk on the crowns, because they will injure them. Next, fill the furrow about half full with well-rotted compost. About 1,500 pounds of a 5-7-7 (NPK) fertilizer should be used in two applications, putting out half at planting time and the other about the first of June. Some farmers use an additional application of 200 pounds of nitrate of soda and manure salts about the first of August. Frequent cultivation is necessary to keep out weeds and grass, and at the last cultivation the rows should be almost level with the surface of the soil.

Fertilization and cultivation should be about the same the second year as the first. These first 2 years are the most important in producing high-yielding asparagus, which means that you must have large, strong, healthy crowns, you must have an almost perfect stand, and you must feed those crowns and treat them kindly by not disturbing the feed roots and buds or eyes by cultivating or allowing weeds and grass to crowd them.

Cutting begins the third year after the crowns have been put out. The season in this section usually begins the last part of March and extends to the tenth of May. Plant a summer legume between the asparagus rows after cutting season, and each year add as much organic material as can be worked into the soil. The asparagus beetle is something to watch out for, as it can break a stand the first 2 or 3 years after putting out.

Extra Quality Profitable

In the fouth year of cutting the yield should average 35 crates per acre, 60 crates per acre for the fifth year, and from the sixth through the twelfth year of cutting 100 crates per acre can be produced. In grading the cuttings there are three qualities: "choice" asparagus which makes 90 spears to the bunch, "fancy" which makes 45 to the bunch, and "colossal" which grades about 25 to the bunch. With a liberal use of balanced fertilizer and good cultivation, much of the choice would be colossal. Since you can cut, grade, and bunch about four bunches of colossal in the same time as one bunch of choice, and one bunch of colossal will sell for at least as much as two bunches of choice, it seems well-worth the extra care and fertilizer needed to produce the extra quality.

When rust began causing damage to their asparagus, farmers started using extra potash. They realized the possibilities of asparagus as a money crop and that it was a hardy feeder and needed a comparatively large amount of fertilizer and all the barnyard compost available. Somehow, they began using 1,000 pounds or more of 5-7-5 (NPK) fertilizer before cutting and

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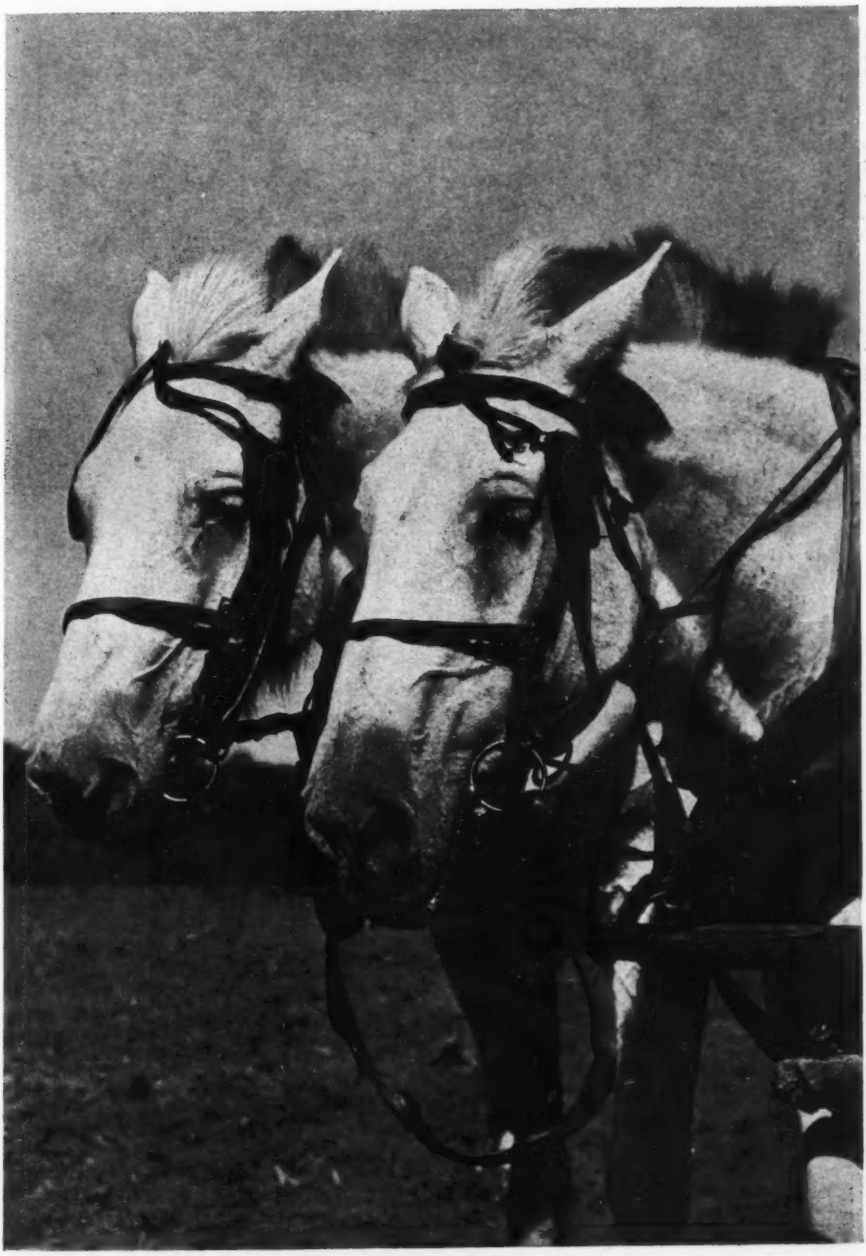
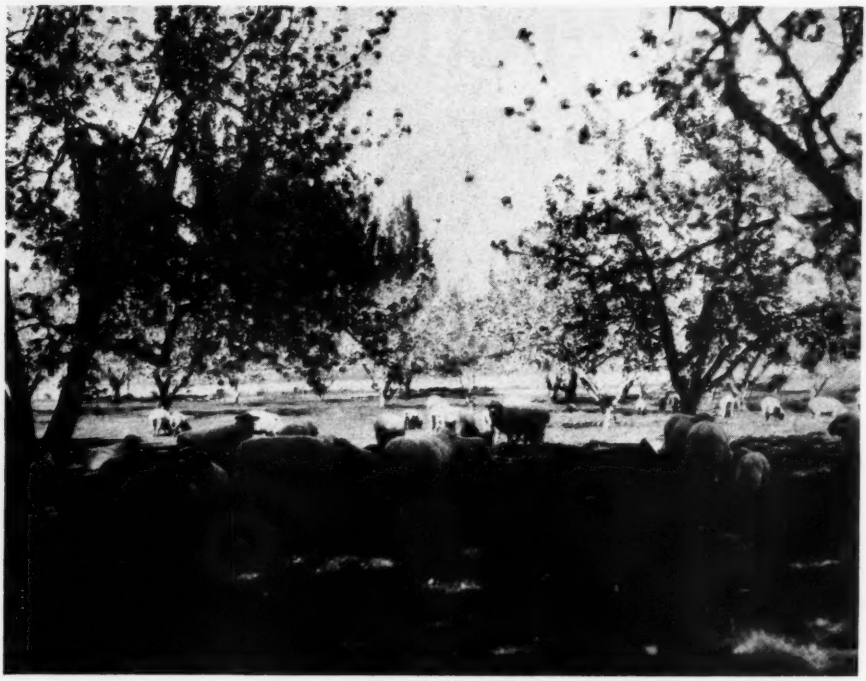
PICTORIAL

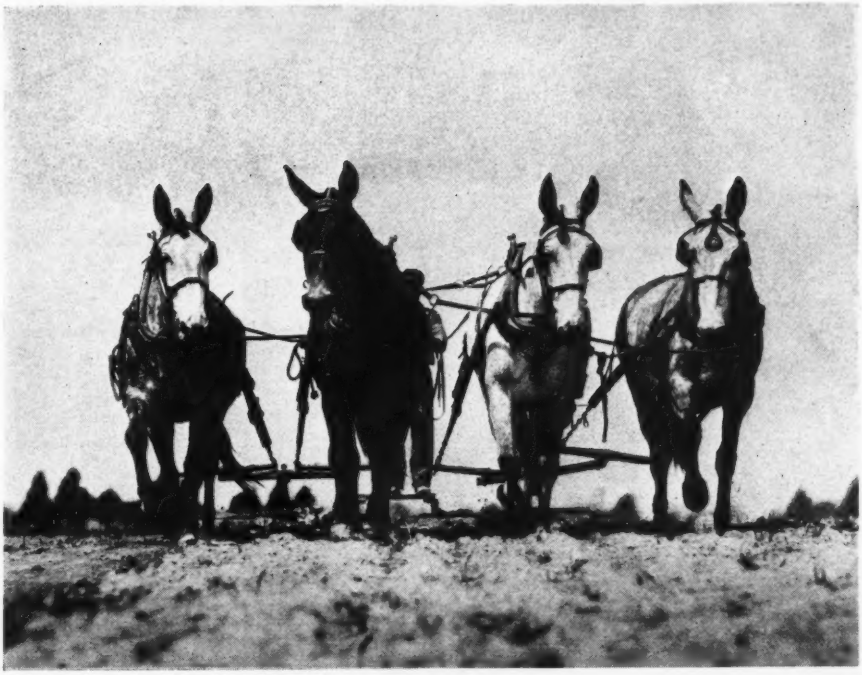


THEY LOOK ALIKE AND ACT ALIKE.

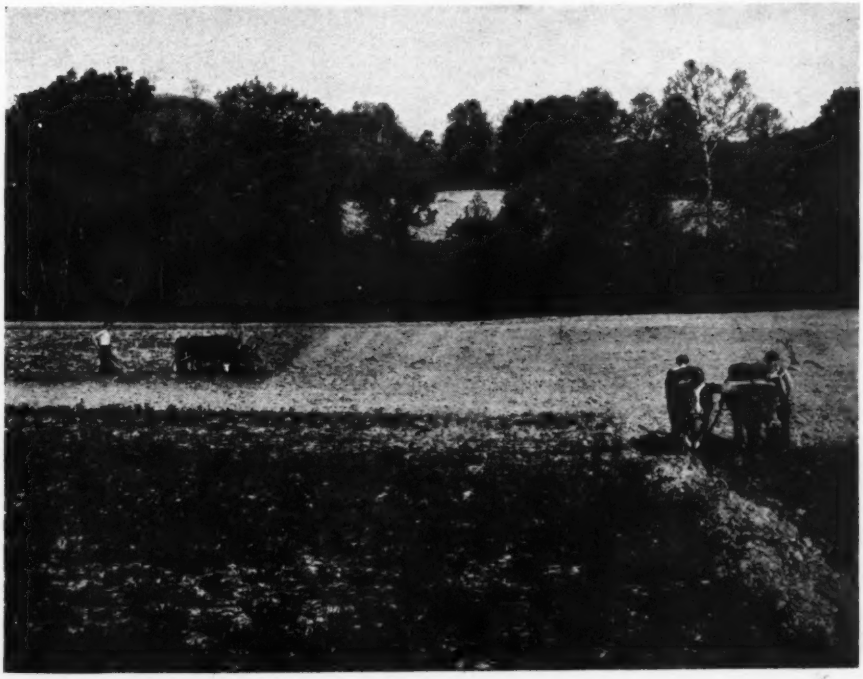


© Agricultural Department of the Union Pacific Railroad.

Above: Spring comes to Idaho. Below: Early stubble fires call for quick action.



Though tractors are seen throughout the country, there's still a need for good farm-power animals.



Left: The modern way: clipping horns on one side, branding on the other.

Below: The long, lazy, afternoon quiet in an Arkansas swamp.

The Editors Talk

Stretching the Fertilizer $

A fertilizer dollar can be stretched. More and more evidence of the economies to be effected in the careful choosing of plant food is coming to light. Important in these investigations is the practicability of using higher analysis fertilizers, and an article by J. J. Skinner, Senior Biochemist, U. S. Department of Agriculture, published in the April issue of the *Progressive Farmer*, well points out and graphically illustrates instances where substantial savings were obtained from increasing the units of plant food in fertilizers purchased.

"We need to recognize first of all that distribution costs, which include cost of bags, labor, taxes, freight, sales costs, dealer's profit, trucking to the farm, mixing, and a few other items, are practically the same per ton (about $12) regardless of the fertilizer bought," Dr. Skinner says. He then goes on to compare prices of low analysis fertilizers with those of higher analysis mixtures, as well as costs of fertilizers made from various sources of plant food, and shows how millions of dollars might be saved on the fertilizer bill of the South.

In the early years of fertilizer usage, analyses were necessarily low because the materials available for making them were of such nature that concentrated fertilizers could not well be prepared. Later when high analysis fertilizers began to come on the market, many feared that the use of such analyses would possibly cause burning, as it was known that low analysis fertilizers applied in amounts large enough to provide plant food necessary for optimum requirements would cause burning unless very carefully applied. Furthermore it was felt that the high purity of the concentrated materials used in the manufacture of high analysis fertilizers would make them less suitable from the standpoint of supplying certain impurities which were contained in low analysis fertilizers and which might be beneficial to plant growth and conducive to large yields.

Research and educational work on methods of application of fertilizers together with the possibility of now making high analysis fertilizers with a total concentration of salts no higher than formerly are dispelling the fear of burning. Thorough experiments conducted by Skinner, Mann, Collins, Batten and Bledsoe in North Carolina, South Carolina, Virginia and Georgia, reported in *Soil Science*, have shown that if the physiological acidity is properly corrected, high analysis fertilizers formulated from high grade chemicals give as good or better yields than the lower analyses. The trend to the use of higher analyses is definitely upward and should be supported by everyone in an advisory capacity.

Dr. Skinner, writing particularly to Southern farmers, cautions his readers:

"When considering your fertilizer problems remember that:

"1. Your fertilizer should contain adequate quantities of calcium, magnesium, and sulphur, as well as the so-called commercial plant foods, nitrogen, phosphorus, and potassium.

"2. All the plant-food elements should be completely available to the crop and at the same time, as far as possible, resistant to leaching.

"3. The continued use of the fertilizer should not have a harmful effect on the soil, such as making it too acid.

"Fertilizer can be made to meet these specifications and at the same time give you more plant food for your fertilizer dollar."

Spring and the Vegetable Garden

There is more to the pleasure of planning and putting in the vegetable garden than the hopes for saving on the food bill and the satisfaction of the spring urge to get outdoors and work with the soil. An inherent appetite for fresh vegetables, not well understood except by those who have scientifically delved into the matter, is responsible in no small degree. These scientists credit various vegetables with definite medicinal values and give point to their use in supporting the proper functioning of the human system.

Whether or not people are becoming better informed on the value of balancing their diet, since 1920 vegetable production has increased more rapidly than the production of any other type of crop. The acreage of truck crops grown for sale has increased 165 per cent since 1919. To meet this growing public appetite for vegetables, more and more experimental work is being done, not only along lines of large yields of quality produce but of maintaining quality until the produce is in the hands of the consumer. The South has greatly expanded its vegetable industry, stimulated by the possibility of supplying northern markets with many out-of-season vegetables. Mississippi is establishing a new truck crop experiment station at Crystal Springs in the truck area south of Jackson. Many other states have experimental stations where the work is devoted to truck crops, indicating the growing importance of vegetables both in agriculture and the diet of the nation. This increased interest in the South is particularly noteworthy since it falls in line with the program of diversification which has long been advocated for the South.

In numerous experiments already conducted in various parts of the country it has been shown that proper fertilization is necessary to produce crops that will carry well, which is highly essential in the shipment of vegetables. Proper fertilization also improves the appearance and thus the marketability of vegetables. Of greatest importance from the viewpoint of our national well-being is the influence of fertilization on the nutritional qualities of truck produce. Experiments at Ohio and other places indicate that the vitamin content may be markedly influenced by fertilization. More recently the influence of fertilization on the properties of vegetables destined for quick-freezing processes is demanding attention. At a national convention recently held in Toronto, Ontario, research in fertilizing for the growing of canning crops, in methods of improving flavor, color, and general appearance, and in the preservation of mineral and vitamin content was stressed as an important requirement for progress in the canning industry.

It will be interesting to watch the new research occasioned by the expansion of the vegetable industry. Undoubtedly out of it will come information applicable to the production of other types of crops.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Dating from 1903 when tobacco investigations were first begun in Ohio at the Germantown Experiment farm in the Miami Valley, pertinent information concerning most phases of successful tobacco growing has been obtained. In Bulletin 590 of the Experiment Station, "Tobacco Cultural and Fertility Tests," by M. A. Bachtell, R. M. Salter, and H. L. Wachter, a very concise summary of these results is given and should certainly prove of much value to Ohio tobacco growers.

While some areas produce a fair percentage of Burley on soils that are suitable for this type, approximately three-fourths of Ohio's tobacco is grown in the Miami Valley where the cigar filler type is best adapted. Tobacco grown in rotation is more profitable than in continuous culture. Higher yields are usually noted after a legume than following corn. To produce healthy, vigorous plants for setting, it is necessary that the plant beds receive special sanitary and fertility treatments, the Bulletin states. Permanent plant beds in the Miami Valley are the rule and are best kept in condition by proper steaming to control disease and by the addition of organic matter to get good tilth. Proper sanitary practices if thoroughly followed after steaming the beds further help to reduce diseases to a minimum. A satisfactory analysis for the plant bed is 4 per cent nitrogen, 8 to 10 per cent potash, and a reasonable percentage of phosphoric acid that is contained in mixtures with the above analyses of nitrogen and potash. About 20 pounds of this fertilizer per 1,000 sq. ft. of plant bed appear adequate. Maximum yields of Ohio Hybrid 224 variety have been obtained from setting plants in the field from June 15 to 25.

The highest average quality is generally secured with the highest yields of an adapted variety. The fertilizers recommended for the light colored silt loams, clay loams, and clay are 2-12-6, 2-14-4, and 4-10-6, at the rate of 500 to 800 pounds per acre, supplemented with a side-dressing of nitrogen. The analyses and rate to use depend on whether the soil was manured or clovered. Larger acre applications of the fertilizers are advised when no manure or legumes are turned under. The fertilizer analyses in this case usually should carry higher percentages of nitrogen and potash. On the lighter colored soils 2-8-10 or 2-12-6 ranging from 300 to 600 pounds per acre should give good results. Here again the fertilization depends on whether or not the soil was manured or a legume turned under. The preferred placement appears to be in lateral bands about 2 inches on either side of the plants and 1 inch below the base of the root crown. On soil with a pH of about 6.0, limestone has caused a small decrease in yields.

The authors also explain other important factors relating to tobacco growing, such as varieties, seed selection, topping, and rotations.

"A Study of the Fertilization of Rice," Agr. Exp. Sta., Baton Rouge, La., Bul. 292, Oct. 1937, J. Fielding Reed and M. B. Sturgis.

"Comparative Value of Cyanamid in Fertilization of Apple Trees, Soil Changes and Tree Response," Agr. Exp. Sta., Columbia, Mo., Bul. 273, Feb. 1938, George E. Smith and A. E. Murneek.

Soils

¶ "Soil Mining or Soil Building?" is the appropriate title of a Wisconsin Special Circular in which C. J. Chapman tells the reader how Wisconsin farmers are losing the fertility of their soils. The author values the plant food lost annually from farm land in this State at 30 million dollars, even where most of the crops grown are fed to livestock and the manure returned to the land. The soils are likewise rapidly losing organic matter and are becoming more and more acid.

The alarming rate of loss of fertility is clearly shown by the inability of the land to produce crops as formerly. Clover seedings have failed in recent years and there is more lodging of grains. Corn does not mature as it did in the early days. Yields of corn and grain have not increased, in spite of improved and higher yielding varieties and better tillage machinery.

Results of fertilizer demonstrations conducted on a wide range of soils for the past 5 years show conclusively that mixtures containing superphosphate and potash pay. Results obtained on 64 farms in southern and central Wisconsin showed a net gain of $1.77 from grain (oats and barley) where 0-20-10 at 200 pounds per acre was compared with the same amount of 0-20-0. That the residual effects of the phosphate and potash mixture are beneficial to the following hay crop was attested by data secured on 25 farms which showed a value of $2.54 was produced in increased yields of hay above that obtained from the superphosphate alone.

The more general use of fertilizers applied at the time of seeding down to alfalfa or hay and pasture mixtures is a recommended practice. Wisconsin farmers already are using considerable fertilizer on cash crops, such as potatoes, sugar beets, etc., and obtain good results from applying fertilizer with an attachment on the corn planter. These practices are also recommended.

Professor Chapman warns that unless something is done in the very near future by shifting the land from soil-depleting to soil-conserving crops and by the use of more fertilizer and lime to maintain a balanced state of fertility, the ultimate prosperity of Wisconsin farmers is in real jeopardy.

¶ Massachusetts agricultural extension officials outline the latest recommendations in connection with the practices established under the Agricultural Conservation Program applicable to that State in Extension Leaflet 175, entitled "Building Massachusetts Soil." The practices recommended by the State officials follow very closely the experience of good farmers and the teachings of agricultural specialists. Included in the comprehensive publication are suggestions for improving hay and pasture crops, building up market garden soils, and orchard soil and woodland improvement. By following the provisions set forth in the Conservation Program, Massachusetts farmers have an excellent opportunity to replace the plant food exhausted from the crop land and to receive assistance in covering part of the expense involved in reseeding hay lands, plowing under growing crops for organic matter, the use of lime where needed, preventing erosion in orchards, and the improvement of forests.

"Conserving Soil by Contour Farming," Agr. Ext. Serv., Columbia, Mo., Cir. 365, May 1937, Marion W. Clark and W. R. Tascher.

"Methods of Growing Plants in Solution and Sand Cultures," Agr. Exp. Sta., New Brunswick, N. J., Bul. 636, Nov. 1937, J. W. Shive and W. R. Robbins.

"Soil Erosion in Ohio," Agr. Exp. Sta.,

Wooster, Ohio, Bul. 589, Dec. 1937, G. W. Conrey, J. S. Cutler, and A. H. Paschall.

"Cultural Experiments With Yellow Bermuda Onions Under Irrigation," Agr. Exp. Sta., College Station, Brazos County, Tex., Bul. 561, Feb. 1938, Leslie R. Hawthorn.

"The Adaptability of Strawberry Clover to Saline Soils," Agr. Exp. Sta., Pullman, Wash., Bul. 353, Jan. 1938, Carl A. Larson.

Crops

¶ The essentials of profitable potato growing in Indiana are detailed and brought up to date in the sixth revised edition of Extension Bulletin 89 entitled "More and Better Potatoes," by W. B. Ward, C. T. Gregory, and C. E. Gould. Observations extending over a period of 10 years have shown the value of planting certified seed, as demonstrated by the average increase of 70 bushels per acre in the State. For early planting the Irish Cobbler leads all other varieties, while Rurals, Chippewa, and Katahdin do well for late planting.

Liberal applications of manure and thorough seed-bed preparation are important prerequisites. To control scab and black scurf, all seed potatoes should receive the corrosive sublimate treatment. From 500 to 1,000 pounds of fertilizer will give profitable increases. Analyses recommended for sandy loams are 3-12-12 and 3-9-18; silt clay loams, 2-12-6, 3-12-12 and 2-16-8; and dark loams and muck, 2-8-16, 3-9-18, 0-8-24, and 0-8-32.

Not less than 20 bushels of seed per acre should be used. Seed pieces weighing 2 ounces each give best results. Four years' experimental work on spraying late potatoes with bordeau mixture resulted in an average increase of 62 bushels per acre. Specifications for most effective spraying and dusting, cultivation, and storage are fully explained by the authors. Finally, the well-graded home-grown potatoes in new clean sacks find a ready market.

"Forty-seventh Annual Report, January 1, to December 31, 1936," Agr. Exp. Sta., Auburn, Ala., M. J. Funchess, Director.

"High-altitude Studies on Dry-land Grasses and Clovers," Agr. Exp. Sta., Fort Collins, Colo., Bul. 439, Nov. 1937, Dwight Koonce.

"Proso or Hog Millet," Agr. Exp. Sta., Fort Collins, Colo., Bul. 438, Nov. 1937, J. J. Curtis, J. F. Brandon, D. W. Robertson.

"Annual Report of the Director for the Fiscal Year Ending June 30, 1937," Agr. Exp. Sta., Newark, Del., Bul. 207, Sept. 1937.

"Austrian Winter Peas and the Vetches for Fertilizer, Feed, and Soil Protection," Agr. Ext. Serv., Athens, Ga., Bul. 453, Revised Jan. 1938, E. D. Alexander.

"Twentieth Annual Report of the Department of Agriculture, July 1, 1936 to June 30, 1937," Dept. of Agr., Illinois, J. H. Lloyd, Director.

"Vegetables" (Second revised edition), Agr. Ext. Serv., Lafayette, Ind., Leaf. 142, Sept. 1937.

"1937 Iowa Corn Yield Test," Agr. Exp. Sta., Ames, Iowa, Bul. 370, Feb. 1938, Joe L. Robinson, R. C. Eckhardt, M. M. Rhoades, and M. S. Zuber.

"Influence of Environmental Factors on the Growth of the Corn Plant Under Field Conditions," Agr. Exp. Sta., Ames, Iowa, Res. Bul. 229, Jan. 1938, Harold F. Eisele.

"Burley-tobacco Project for 4-H Clubs," Agr. Ext. Serv., Lexington, Ky., Cir. 289, Jan. 1938, E. J. Kinney.

"Alfalfa in Minnesota," Agr. Ext. Serv., University Farm, St. Paul, Minn., Sp. Bul. 104, Revised Mar. 1937, A. C. Arny.

"Top and Double Working, and Bridge Grafting of Fruit Trees," Agr. Exp. Sta., Columbia, Mo., Cir. 196, Feb. 1938, T. J. Talbert.

"Growing Potatoes," Agr. Exp. Sta., Columbia, Mo., Cir. 197, Mar. 1938, R. A. Schroeder, J. W. C. Anderson, and T. J. Talbert.

"Evaluation of Varieties of Peaches in the Northeast," Agr. Exp. Sta., Durham, N. H., Sta. Cir. 54, Nov. 1937, M. A. Blake.

"Fifty-sixth Annual Report for the Fiscal Year Ended June 30, 1937," Agr. Exp. Sta., Geneva, N. Y., U. P. Hedrick, Director.

"Fifty-eighth Annual Report of the North Carolina Agricultural Experiment Station, for the Fiscal Year Ending June 30, 1935, Progress Report for Year Ending December 1, 1935," Agr. Exp. Sta., Raleigh, N. C., R. Y. Winters, Director.

"Lawns," Agr. Ext. Serv., Columbus, Ohio, Bul. 129, Revised June 1937, George M. McClure, C. J. Willard, and F. A. Welton.

"A Program for Shade Trees in Oklahoma," Agr. Exp. Sta., Stillwater, Okla., Bul. 234, Jan. 1938, K. Starr Chester, H. J. Harper, R. O. Monosmith, and F. A. Fenton.

"Fiftieth Annual Report of the South Carolina Experiment Station for the Year Ended June 30, 1937," Agr. Exp. Sta., Clemson, S. C., Dec. 1937, H. P. Cooper, Director.

"Studies on Tobacco Downy Mildew in Virginia," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 62, Nov. 1937, R. G. Henderson.

"Foreign Agricultural Extension Activities," U. S. D. A., Washington, D. C., Ext. Serv. Cir. 262, May 1937, M. C. Wilson.

"Over a Million 4-H Club Members, a Review of 4-H Club Work in 1936," U. S. D. A., Washington, D. C., Ext. Serv. Cir. 274, Dec. 1937, Charles E. Potter.

"The Tung Tree," U. S. D. A., Washington, D. C., Revised Jan. 4, 1938, H. L. Crane and Robert A. Young.

"A Digest of Some World Pasture Research Literature," (Exclusive of the Continental United States and Canada), U. S. D. A., Washington, D. C., Dec. 1937, A. J. Pieters.

Economics

¶ According to the annual fertilizer sales report compiled by the Department of Agronomy at the Ohio State University, the recovery in the fertilizer business in Ohio continued in 1937, reaching an all-time high of 362,205 tons of all fertilizers sold. This is 11 per cent larger than the 337,146 tons sold in 1936 and 11 per cent larger than the pre-depression peak of 338,662 tons sold in 1929.

Fertilizer sales in Ohio are fairly evenly divided between spring and fall, 180,215 tons being sold in the spring, and 181,990 tons sold in the fall. Of the total 1937 sales, 201,103 tons were represented by the 21 designated standard analyses, all of which contain 20 per cent or more plant food. There were sales of 65,356 tons of materials and 95,707 tons of miscellaneous analyses, most of which contain less than 20 per cent plant food.

The most important single analysis sold in the State is 2-12-6, which constitutes 143,143 tons of the total sales. The next most important mixed fertilizer is 2-12-2 with 41,526 tons, followed by 0-14-6 with 21,421 tons. Particularly significant is the trend toward the standard analyses.

¶ According to the annual report of the Inspection and Regulatory Service, College Park, Maryland (Maryland Fertilizer Facts for 1937), 92 firms represented by 970 different brands and 98 different analyses sold a total of 186,285 tons of fertilizer in 1937 in the State. Of this total, 144,575 tons were complete fertilizers of 73 different grades, and 15,724 tons were superphosphate and potash mixtures. Sales of materials included 700 tons of nitrogen salts, 12,785 tons of superphosphate, and 1,210 tons of potash salts. There were 4,505 tons of nitrogen, 14,508 tons of phosphoric acid, and 10,954 tons of potash contained in mixed fertilizers sold.

The leading single analysis was 2-9-5 with sales of 37,438 tons, which was followed by 6-6-5 with 14,758 tons, 2-12-6 with 12,524 tons, 2-8-10 with 11,377 tons, and 4-8-7 with 10,215 tons. Of the total tonnage sold, 123,007 tons were of the Maryland standard analyses recommended for 1937, none of which contained less than 16 per cent plant food, and the only one containing as little as 16 per cent was 2-9-5.

In 1936, mixed fertilizer sales totaled 139,290 tons, and contained 3,870 tons of nitrogen, 12,605 tons of P_2O_5, and 8,904 tons of K_2O.

¶ The Monthly Bulletin of Agricultural Statistics for Canada, January 1938, included a very nice summary of the fertilizer trade in Canada covering the fertilizer year July 1, 1936, to June 30, 1937. This report is prepared through the cooperation of the Mining, Metallurgical, and Chemical Branch of the Dominion Bureau of Statistics and the Fertilizer Division of the Federal Department of Agriculture.

The total production of fertilizer in 1936-37 reached 579,196 short tons or an increase of 33 per cent over the preceding year. Of this total 229,888 tons were mixed fertilizers; 162,509 tons were calcium cyanamide; 79,556 tons were sulphate of ammonia; 66,967 tons were superphosphate; and 32,151 tons were ammonia phosphate. During the year, sales for Canadian consumption reached 298,276 tons, representing an increase of 27.6 per cent over the preceding year. The

most popular mixture was 2-12-6, with 68 per cent of the tonnage of this analysis consumed in Ontario, and 20 per cent in Quebec. The next most important brand was 4-8-10. Approximately 10,258 tons of nitrogen, 37,027 tons of phosphoric acid, and 19,441 tons of potash were contained in the fertilizers used in Canada during the year 1936-37.

"The Agricultural Outlook for 1938," *Agr. Ext. Serv., Storrs, Conn., Vol.* 33, *No.* 3, *Nov.* 1937.

"Quarterly Bulletin," St. Bd. of Agr., Dover, Del., Vol. 27, *No.* 4, *for Quarter Ending Dec.* 31, 1937.

"1938 *Agricultural Outlook for Idaho," Agr. Ext. Serv., Boise, Idaho, Ext. Cir.* 59, *Dec.* 1937, *Karl Hobson and Ezra T. Benson.*

"Illinois Farm Economics," Agr. Ext. Serv., Urbana, Ill., No. 33, *Feb.* 1938.

"The Importance of the Fruit and Vegetable Industry in Louisiana," Agr. Exp. Sta., Baton Rouge, La., Bul. 294, *Jan.* 1938, *Roy A. Ballinger.*

"Crop Report for Michigan, December 1937," *Mich. Dept. of Agr., Lansing, Mich., Verne H. Church and Grant D. Clark.*

"Family Living on Poorer and Better Soil," Agr. Exp. Sta., State College, Miss., Bul. 320, *Sept.* 1937, *Dorthy Dickins.*

"Some Economic and Social Aspects of Irrigation in Montana," Agr. Exp. Sta., Bozeman, Mont., Bul. 354, *Jan.* 1938, *P. L. Slagsvold and J. D. Mathews.*

"Inspection of Commercial Fertilizers for 1937," *Agr. Exp. Sta., Durham, N. H., Bul.* 301, *Dec.* 1937, *T. O. Smith and H. A. Davis.*

"Cotton Marketing in the Salisbury Area of North Carolina," Agr. Exp. Sta., Raleigh, N. C., Bul. 317, *Dec.* 1937, *J. W. Wright, G. R. Smith, and J. A. Shanklin.*

"The Farm Outlook for South Carolina 1938," *Agr. Ext. Serv., Clemson, S. C., Cir.* 160, *Jan.* 1938, *D. W. Watkins, Director.*

"Department of Agriculture-Immigration of Virginia," Richmond, Va., Bul. 357, *Mar.* 1938.

"Do Wisconsin Farmers Need a Dairy Program?", Agr. Ext. Serv., Madison, Wis., Sp. Cir., Jan. 1938.

"What Does Northern Wisconsin Farming Need Most?", Agr. Ext. Serv., Madison, Wis., Sp. Cir., Feb. 1938, *W. A. Rowlands.*

"Report of the Administrator of the Resettlement Administration, 1937," *U. S. D. A., Washington, D. C., Will W. Alexander.*

"Report of the Chief of the Bureau of Agricultural Economics, 1937," *U. S. D. A., Washington, D. C., A. G. Black.*

"Some Problems in Marketing Tomatoes Grown in the Lower Rio Grande Valley of Texas," U. S. D. A., AAA, Washington, D. C., GCM-4, Jan. 1938.

"Some Problems Involved in Establishing Milk Prices," U. S. D. A., AAA, Washington, D. C., DM-2, Sept. 1937, *E. W. Gaumnitz and O. M. Reed.*

"The New Farm Act, A Short Summary of the Provisions of the Agricultural Adjustment Act of 1938," *U. S. D. A., AAA, Washington, D. C., G-83, Feb.* 1938.

"Marketing Quotas for Cotton?", U. S. D. A., AAA, Washington, D. C., 38-Cotton-2, Feb. 1938.

"Flue-cured Tobacco Facts," U. S. D. A., AAA, Washington, D. C., 38-Tobacco-1, Feb. 1938.

"The Agricultural Adjustment Act of 1938 *in Relation to Flue-cured Tobacco," U. S. D. A., AAA, Washington, D. C., 38-Tobacco-2, Feb.* 1938.

"Fire-cured and Dark Air-cured Tobacco, The Economic Situation and the New Act," U. S. D. A., AAA, Washington, D. C., 38-Tobacco-3, Feb. 1938.

"A Study of Factors Affecting the Price of Dry Edible Beans in the United States, By Classes, 1922-23 *to* 1934-35," *U. S. D. A., Washington, D. C., Feb.* 1938, *Janet Murray.*

"Land Classification for Land Use Planning in the Great Lakes Cut-over Region as Illustrated by Forest County, Wisconsin," U. S. D. A., Washington, D. C., Land Ec. Rpt. No. 1, 1937, *William F. Musbach.*

"Statistical Results of Cooperative Extension Work, 1936," *U. S. D. A., Washington, D. C., Ext. Cir.* 266, *June* 1937, *M. C. Wilson.*

Mr. Pender Specializes in Asparagus

(*From page* 22)

500 pounds or more of some form of potash after cutting season. The most popular potash fertilizer for years was the old 12.4 per cent kainit. Now, manure salts seem to be the most popular.

Since 1915, practically all the asparagus shipped from this section has been green asparagus. Various sized crates were used at first, but they dwindled down to the 12- and 24-bunch size, and now the 12-bunch crate is used altogether.

Many improvements in marketing

asparagus were brought about by the South Carolina Asparagus Growers Association, an organization which came into existence through the efforts of Broadas Knight in 1912 and included growers from the several asparagus-producing counties in the State. They standardized the crate, grades, and the bunch. In 1918 the association employed a grader to visit the different shipping points and instruct producers in preparing asparagus for shipping. By 1927 they had government graders at each shipping point and began using wax paper in the bottom of crates to retain the moisture. In 1932 the bunches were wrapped in cellophane for the first time. They were shipping as high as 205 carloads of asparagus in 1930—quite an increase over the production in 1908 when the first complete carload went out from this section.

About 90 per cent of the asparagus shipped from South Carolina in 1929 was marketed by the association, but shortly thereafter it began to lose ground and had completely disappeared by 1935. There are some small marketing associations now, but a large part of the produce is sold for cash at the local shipping point to speculators and a few commission merchants. The rest is shipped on consignment.

When one realizes that asparagus was not introduced into South Carolina until 1885, when Lewis Thompson, of Barnwell County, planted 2 acres, and that its possibilities as a money crop were not recognized until 1905, the present 3,000 acres of asparagus at producing age are a startling increase. However, a large number of acres now being cut came through the fertilizer depression years of 1932 and 1933, when the total amount of commercial fertilizer used dropped 63 per cent from what it was in 1931. These fields will not produce profitably again. Farmers who have put out young beds since that time and those who have followed sound practices through 1932 and 33 are still producing quantity and quality asparagus.

The most successful farmers are producing around 100 crates per acre, and have found 1,500 pounds of a 5-7-5 or 5-7-7 fertilizer when beds are being prepared for the cutting season, 200 pounds of nitrate of soda at the beginning of the cutting season, and 600 pounds of manure salts after cutting season good fertilizer treatment for asparagus of cutting age.

Profitable Cows Need Productive Pasture

(*From page 9*)

equivalent to 500 pounds of a 10-20-20 complete fertilizer (assuming only one-half of the nitrogen in farm manure is available to the immediate crop).

It is very important to recognize that these old pastures are as deficient of available potash as they are of available phosphorus. Figures 2 and 3 show the response from phosphorus only, and phosphorus plus potash, on a typical "run-out" permanent pasture soil. These tests were made in the greenhouse under ideal conditions of temperature and moisture, and even under these ideal conditions phosphorus alone proved very ineffective as an initial permanent pasture topdressing treatment. Further, field experiments have shown that an initial treatment of complete fertilizer is far more effective in bringing about tremendous changes in yield and flora than is manure or any combination of commercial fertilizer that does not include nitrogen, phosphorus, and pot-

ash. Later, as the pasture becomes more productive, a soil test will show what fertilizing constituents should be given special consideration.

Pasture crops other than permanent pasture are usually referred to as supplementary pasture crops. This is a misnomer. Crops that will furnish an abundance of green pasture feed at a time when the improved permanent pasture regularly will not take care of the milking herd are equally as important a part of an all-season pasture program as is the improved permanent pasture.

The Maine farmer has found that the grazing of as much of the small grain nurse crop as possible has proved far more valuable than allowing it to ripen off for grain. Oats are at the proper stage for grazing, the fifth leaf stage, when feed on the improved permanent pasture is beginning to get too scarce for cows in full milk. This crop fits into any pasture scheme in the Northeast based on an abundance of green feed for the milking herd.

Sudan grass also has a place in an all-season pasture program in the Northeast. This crop will carry cows in full milk through the month of August better than, possibly, any other crop. Cows like it, and they milk on it.

Regularly a small portion of the hayland should be seeded down to Ladino clover for pasture. This crop, like Sudan grass, is quite drought-resistant and will furnish an abundance of late summer feed as well as early spring pasturage.

Finally, more attention to adequate fertilization of the meadowland and early cutting of the hay crop will result in a more abundant aftermath which can best be used for late summer and early fall pasture.

The procedure to follow in fertilizing these cropland pastures should also be determined from a chemical analysis of the soil. A soil analysis pretty largely speaks for itself. If the soil is low in available phosphorus, the important item is to get superphosphate on the land. A convenient way for the dairy farmer to get superphosphate on the land is in conjunction with the manure-spreading operation. Superphosphate may be used daily on the floors of the stable, or spread directly on the top of each load of manure at the time of hauling. It, of course, can be spread directly on the land.

Low Available Potash

On many dairy farms the soil is low in available potash. This is partly the result of improper handling of farm manure. Manure should be broadcast on top of plowed ground as it is made, allowing the rain to purify it there rather than in a pile, under the eaves, alongside of the barn.

One should bear in mind that lime does not neutralize soil acids quickly and effectively when applied on top of sod ground. Much of the land seeded down may not be plowed for several years. The best, and really only time, to satisfy the lime requirements of a soil is to broadcast lime following plowing and mix it thoroughly with the surface soil prior to seeding down.

Finally, if a soil test or crop management calls for a particular plant-food element, extra increments of this element should be added in the form of commercial fertilizer. Manure applications heavier than 10 tons per acre are not economical and will not correctly satisfy soil plant-food deficiencies. There is sufficient evidence to show that farm manure alone will not maintain soil fertility on the average dairy farm. Dairy farmers, by and large, must make use of commercial plant food to bring their soils to an optimum level of soil fertility. Cows are built for handling large quantities of roughage; it takes a fertile soil to produce abundant, high quality roughage, which our dairy cow of today demands.

Mississippi Soil Types and Their Preferences

(*From page* 12)

to 1,704 pounds per acre, or an increase of 474 pounds as a result of adding 24 pounds potash.

Instead of continuing with these individual farm reports we will pass to the experiment station reports as obtained at the State Experiment Station and in cooperation with the Junior Colleges of the State. Table I is taken from Information Sheet No. 122, issued November 1937 by the Mississippi Experiment Station, State College, Mississippi.

From the above table we see that an application of 600 pounds of 4-8-4 produced a profit over cost of fertilizer of $8.14, but by increasing the analysis to 4-8-8 the profit over cost of fertilizer was raised to $13.78. The table (second line) also shows that when the potash was omitted, using 600 pounds of 4-8-0, the profit was reduced to $1.45 and the yield dropped from 1,116 to 765 pounds per acre. the profit was increased to $26.56. A further increase to $28.59 was made upon increasing the potash to 12 pounds per hundred.

From Information Sheet 96, issued December 1935, the Mississippi Experiment Station at Holly Springs gives the results in Table III.

Upon referring to Table III it is seen that at Holly Springs Experiment Station a 10-year test on Memphis Silt Loam (Hill land) showed that 4-8-8 applied at the rate of 600 pounds per acre produced an average of 507 pounds over no fertilizer, and that 600 pounds of 4-8-4 over a 10-year period produced an average of 519 pounds per acre over no fertilizer. From this it is seen that there was no increase as a result of the additional potash; in fact, the higher analysis has a record of 12 pounds per year less yield. This is infinitesimal, still it shows that there was no response to

TABLE II—ANALYSIS TEST—SOUTHWEST—SUMMIT—CADDO VERY FINE SANDY LOAM

Treatment	Seed cotton per acre	Increase over no fertilizer	* Value of crop	Gain over no fertilizer	Cost of fertilizer	Profit over fertilizer
600# 4–8–4	881	651	$35.24	$26.04	$7.86	$18.18
600# 4–8–0	531	301	21.24	12.04	6.99	5.85
600# 4–8–8	1,112	882	44.48	35.26	8.70	26.56
600# 4–8–12	1,184	954	47.36	38.16	9.57	28.59
600# 0–8–4	770	540	30.80	21.60	5.58	16.02
600# 6–8–4	954	724	38.16	28.96	8.97	19.99
600# 8–8–4	945	715	37.80	28.60	10.11	18.49
600# 4–4–4	725	495	29.00	19.80	6.99	12.81
600# 4–12–4	878	648	35.12	25.92	8.70	17.22
600# 4–0–4	567	337	22.68	13.48	6.12	7.36
No fertilizer	230	...	9.20	....	....	....

* Value at 4c per pound for seed cotton.

By referring to Table II we see that 600 pounds of 4-8-4 produced a profit over cost of fertilizer of $18.18, but when the potash was left out and the same amount of 4-8-0 used, the profit fell to $5.85 per acre. The analysis was then raised to 4-8-8 and the usual amount applied, with the result that an application of additional potash. We do find though, that when the potash was omitted and 4-8-0 applied at the same rate as above, the average yield over no fertilizer was reduced to 382 pounds per acre. Thus it does appear that, while no great amount of potash is necessary on Memphis Silt

TABLE III—COTTON FERTILIZER ANALYSIS TEST ON MEMPHIS SILT LOAM (HILL LAND), HOLLY SPRINGS STATION, HOLLY SPRINGS, MISS.

Analysis	Rate per acre, lbs.	Yield 1935	Increase over no fertilizer, 1935	Increase over no fertilizer, 10-year average
4-8-8	600	884	339	507
4-8-6	600	908	418	453
4-8-4	600	896	401	519
4-8-2	600	856	371	444
4-8-0	600	832	362	382
8-8-0	600	980	525	578
8-8-4	600	932	481	502
6-8-4	600	882	412	422
4-6-4	600	872	383	368
4-4-4	600	904	435	461*
4-10-8	600	898	424	470*
4-12-8	600	876	397	417*
4-8-10	600	888	404	449*
4-8-12	600	...	...	697**
4-8-4	1,200	...	...	780**
4-8-4	1,800	...	...	859**
4-8-4	2,400	...	...	...
Av. check	....	521	...	540

* 3-year average.
** 7-year average.

Loam, there must be a reasonable amount used if best results are to be gotten.

Table IV gives the result of a test run on the same experiment station as the one reported in Table III, but on Lintonia instead of Memphis soil. This soil shows a difference in its response when the analysis was changed to 4-8-4 there was a reduction in the average yield over no fertilizer to 617 pounds, a reduction of 165 pounds. There was a still further reduction to 242 pounds when the analysis was changed to 4-8-0 and the same amount used.

TABLE IV—COTTON FERTILIZER ANALYSIS TEST ON LINTONIA SILT LOAM (VALLEY LAND), HOLLY SPRINGS STATION, HOLLY SPRINGS, MISS.

Analysis	Rate per acre, lbs.	Yield 1935	Increase over no fertilizer, 1935	Increase over no fertilizer, 10-year average
4-8-8	600	1,228	566	782
4-8-6	600	1,328	616	720
4-8-4	600	1,212	504	617
4-8-2	600	1,196	481	459
4-8-0	600	960	234	242
8-8-4	600	1,424	687	606
6-8-4	600	1,352	611	634
4-6-4	600	1,208	474	578
4-4-4	600	1,224	497	532
4-8-4	1,200	...	...	728*
4-8-4	1,800	...	...	799*
4-8-4	2,400	...	...	851*
Av. check	723	...	...	924

* 7-year average.

as indicated by the following results: 600 pounds 4-8-8 over a 10-year period produced an average increased yield of 782 pounds over the no fertilizer plot. But unlike the Memphis Silt Loam on the same farm, these results seem to indicate that soils differ in their response to fertilizer, and that some soils have more of some plant foods available than other soils do. Thus it is to the interest of the farmer to identify his

soils and search experiment station reports and the results from other reliable sources for information before determining his fertilizer practice.

Now I am sure that one peal of thunder does not make a flood, no more than do the results of one test establish a fact. But one peal of thunder does suggest the direction from which rain is likely to come, just as the results of these potato potash tests, while establishing no definite facts, do suggest the direction from which we may get some worth-while information in the future. It is true that tests of this nature must be repeated several years before the results are really conclusive. However, when the response is so decided we are inclined to watch similar work with interest and to inwardly expect the results to continue in the same general direction.

Corn on Alkali Soils Responds to Potash

(*From page* 16)

check rows between each treatment. An 0-12-12 fertilizer was used on the rest of the field at a rate of about 100 pounds per acre. A marked difference between the fertilized and unfertilized plots could be noted as soon as the corn came up. The unfertilized rows were slower in starting and soon showed "firing" of the leaves. The difference between fertilized and unfertilized rows during June is shown in figure 2. The corn on all fertilized plots grew well and showed no potash starvation until late July, when the 0-20-10 plot and the 0-12-12 area began to show marginal firing of the leaves.

The 0-9-27 plot still retained its normal green color, and the 0-20-20 plot showed very slight firing. Both were tasseled out and had strong, well-developed stalks, as shown in figure 3. The following harvest data bear out observations made during the season. The 0-9-27 and 0-20-20 plots out-yielded the 0-20-10 and 0-12-12 plots, an average of 13.8 bushels per acre, and out-yielded the check plots 29.2 bushels. A very profitable return over fertilizer costs was obtained on these plots as indicated by the following data. The slight increase of 0-20-20 over 0-9-27 is probably due to the fact that the field is low in general fertility. Corn values were figured at 50c per bushel for marketable and 25c for unmarketable corn.

CLARK CLEMENT PLOT DATA, GARNER, IOWA

Soil treatment lb. per acre	Yield per acre, bu.	% Marketable corn	Value per acre 50c & 25c bu.	Fertilizer costs per acre,	Net value above fert. costs	Net increase due to fert.
100 lb. 0-12-12....	34.5	79.9	$15.52	$1.50	$14.02	$8.70
120 lb. 0-9-27.....	44.2	91.8	21.20	2.57	18.63	11.55
Check	14.2	50.0	5.32	....	5.32	....
120 lb. 0-20-20....	48.8	94.0	23.68	3.04	20.64	13.56
Check	20.3	74.2	8.85	....	8.85	....
120 lb. 0-20-10....	32.0	87.4	15.00	2.14	12.86	5.78

Fertilizer costs: 100 lb. 0-12-20 = $1.50 120 lb. 0-20-20 = $3.04.
120 lb. 0- 9-27 = $2.57 120 lb. 0-20-10 = $2.14.

As shown by the summary of results the 0-20-20 and 0-9-27 gave the best results. (See Table I.)

In 1937, as in the 2 previous years, a series of plots were run on the alkali

TABLE I.—SUMMARY OF RESULTS OF PLANTER ATTACHMENT FERTILIZER DEMONSTRATIONS CONDUCTED ON "ALKALI" SOILS IN NINE NORTHERN IOWA COUNTIES, 1937

Series I.—On areas of low alkalinity—Average yields for 8 farms

Fertilizer *	Bu. Corn per Acre	Per cent † Marketable Corn	Increase Due to Fertilizer Yield per A.	% Marketable Corn
0-20-0	60.6	93.2	3.2 Bu.	14.4%
Check	57.4	78.8		
0-20-10	69.3	93.6	12.3	15.2
Check	57.0	78.4		
0-20-20	63.4	91.3	5.8	27.5
Check	57.6	63.8		

Series II.—Conducted on areas of high alkalinity—Average yields for 10 farms

Fertilizer *	Bu. Corn per Acre	Per cent † Marketable Corn	Increase Due to Fertilizer Yield per A.	% Marketable Corn
0-20-10	51.7	89.8	11.5	16.0
Check	40.2	73.8		
0-20-20	54.9	92.7	17.8	22.1
Check	37.1	70.6		
0-9-27	55.6	92.0	19.1	20.1
Check	36.5	71.9		

* Rates varied from 125 to 140 lbs. per acre on different farms. Rate same, however, on each farm.

† Closely associated with moisture content. Corn from check plots was usually higher in moisture at harvest time.

soils after the symptoms of potash starvation had appeared. The applications were made with a cultivator having a fertilizer attachment with discs substituted for the inside front shovels. The fertilizer was applied as near the corn plant as possible and at a depth of about 2½ to 3 inches. Fertilizer should be applied as close to the plant as possible to cultivate in moist soil, so that it can become available quickly.

Potash Effects Recovery

One series of plots was treated about the first of June, at the normal time for the first plowing. Potash starvation or firing was beginning to show at this time. Within a month the potash caused the corn to turn back to a normal green.

A second series of plots was treated about a month after the first, and at that time many corn plants on these plots were suffering severely from potash starvation. Many of the plants had died and those remaining were severely stunted. However, applications of 100 and 200 pounds per acre as side-dressings at that time proved profitable, as can be seen from the summary of these plots in Table II.

About a month later observations on the second series of plots showed that the plants were recovering.

Typical of the side-dressing demonstrations on "hot" alkali were those conducted on the Ray Frye farm near Dows in Wright County, Iowa. This field had several areas which were extremely "hot" and other areas not alkaline which would grow a normal crop of corn. Soil samples from the area on which the tests were run showed an acid-neutralizing value of 37 per cent.

Part of the area was treated early in June at 3 different rates—100, 200, and 500 pounds of muriate of potash per acre. Corn plants at this time were showing distinct signs of potash starvation. The stand was poor on

Fig. 5—Showing size of roots and stalks from Paul Rule plot, Waterloo, Iowa, Oct. 1937. Left: roots and stalks from hill side-dressed in June with muriate of potash. Right: hill from unfertilized row next to it.

this area, and the plants looked withered and showed considerable firing.

The balance of the area was treated the last week of June, at which time the early treatment plots had turned normal green in color and were approximately the same size as the corn on normal soils in the field. Only two rates were used for this application—100 and 200 pounds of muriate of potash.

By August 1 these plots were showing normal color and were tasseled out. Extreme difference could be noted between "no treatment" plots and "early June applications" as shown in figure 4. Harvest data following show the advantage in yield of the plots side-dressed with potash early. A difference of 47 bushels per acre over the check was obtained on the plot treated with 200 pounds of muriate of potash early in June.

Applications after July 1 proved profitable on other plots conducted on "hot" alkali. Corn treated with potash fertilizer improved particularly in size and strength of stalk and roots as well as in yield of grain. Figure 5 shows a comparison of stalks and roots from a hill treated with potash and one next to it with no treatment on the Paul Rule farm in Black Hawk County.

RAY FRYE PLOT DATA, DOWS, IOWA

Soil treatment	Yield per acre, bu.	% marketable corn	Value per acre* 50c & 25c bu.	Fert. costs per acre	Net value above fert. costs	Net increase due to potash
500 lb. 0-0-50 S. Dr. June 8...	60.5	96.8	$29.78	$11.35	$18.43	$7.55
Check	24.9	74.5	10.88	....	10.88	....
200 lb. 0-0-50 S. Dr. June 29..	50.8	95.5	24.83	4.54	20.29	9.41
200 lb. 0-0-50 S. Dr. June 8...	67.1	97.2	33.08	4.54	28.54	19.52
Check	20.3	78.0	9.02	....	9.02	....
100 lb. 0-0-50 S. Dr. June 8...	67.1	95.9	32.85	2.27	30.58	21.85
Check	19.8	76.2	8.73	....	8.73	....
100 lb. 0-0-50 S. Dr. June 29..	53.3	91.3	25.50	2.27	23.23	14.50

* Value of marketable corn figured at 50c per bu. and unmarketable at 25c. Muriate of potash is figured at cost of $2.27 per 100 lb.

Following is a summary of cultivator attachment side-dressing plots conducted on alkali soils in northern Iowa counties during 1937. (See Table II.)

Fertilizer Recommendations

Results obtained over a period of years have shown that potash applied to "hot alkali" soils gives consistently good results. In general, corn plants on these soils need from about 30 to 50 pounds of actual potash (K_2O) per acre if applied in the hill and considerably more if applied broadcast. This would be added by applying 60 to 100 pounds of muriate of potash or other fertilizers applied on a potash equivalent basis.

Previous work has indicated that heavy applications of 200 to 1,000 pounds per acre as a broadcast treatment are not satisfactory over a period of time, because the potash seems to "lock up" again in an insoluble combination that is unavailable to the plant. Since this is true the practical thing to do is to apply the fertilizer in the hill at planting time. Where over 50 per cent of the entire area of the field is alkaline, 0-9-27 or 0-0-50 in the hill at planting time is recommended. The rate of application should be varied according to the degree of alkalinity.

However, where less than 50 per cent of the field is alkaline, but where many small areas are present, it is recommended to apply 0-14-14 or 0-12-12 in the hill and side-dress the alkali spots with 60 to 100 pounds of 0-0-50 per acre at the time of the first or second cultivation. Where no fertilizer is applied at planting time, 100 to 200 pounds of muriate of potash at time of the first or second cultivation are recommended. Cultivator attachments for applying this fertilizer can be secured from the larger machinery companies. The cost of such attachments is not high as compared with the value of increase

TABLE II.—SUMMARY OF RESULTS OF CULTIVATOR ATTACHMENTS—POTASH SIDE-DRESSING DEMONSTRATIONS CONDUCTED IN NINE NORTHERN IOWA COUNTIES IN 1937. MURIATE OF POTASH APPLIED AFTER POTASH STARVATION SYMPTOMS APPEARED

Series I.—Early and late applications in same fields—Average yields on 11 farms

Fertilizer	Bu. Corn per Acre		Per cent * Marketable Corn		Increase Due to Fertilizer Yield Bu. per A.		Increase Due to Fertilizer % Marketable Corn	
	Early	Late	Early	Late	Early	Late	Early	Late
100 lb. 0-0-50	54.7	52.8	93.7	96.4	14.2	11.0	9.6	11.9
Check	40.5	41.8	84.1	84.5				
200 lb. 0-0-50	60.5	55.2	95.5	92.2	20.4	10.6	11.3	5.6
Check	40.1	44.6	84.2	86.6				

Series II.—Late applications only—6 farms

Fertilizer	Bu. Corn per Acre		Per cent * Marketable Corn		Increase Due to Fertilizer Yield Bu. per A.		Increase Due to Fertilizer % Marketable Corn	
	Early	Late	Early	Late	Early	Late	Early	Late
100 lb. 0-0-50	...	65.3	...	93.0	...	8.9	...	6.9
Check	...	56.5	...	86.1				
200 lb. 0-0-50	...	66.8	...	92.7	...	12.9	...	7.9
Check	...	53.9	...	84.8				

* Closely associated with moisture content. Corn from check plots was usually higher in moisture content at harvest time.

Early applications made in early June or approximately at time of first cultivation.

Late applications made in late June and early July or at approximate time of last cultivation.

in the corn yields that can be obtained by applying potash fertilizer on these areas.

For more information on these recommendations, farmers may consult their county agent and extension service representative of Iowa State College. Soil samples from these areas may be sent to the Soils Subsection of the Agricultural Experiment Station for analysis. Fertilizer recommendations will be based on results from these tests and the field work carried on to date on these areas. Without potash fertilizer these alkali spots are very unprofitable, but with fertilizer they can be made as productive as the best land on the farm.

New Approaches to Potash Fertilization

(*From page 19*)

vorable climatic conditions were eliminated and soil drainage were adequate, the Bladen soil considered in this test would have a crop-producing power of about two-thirds and the Norfolk one-third of that of the Portsmouth soil for beets. The picture changes slightly for other crops considered, but the relation of one soil to another remains about the same.

The crop-producing power of the soil is determined to adequately answer the question of how much potash a grower must use on his soil. The grower must first consider just how much of a given crop he expects to produce. Obviously, if the soil is extremely acid and lime or calcium and magnesium are the limiting factors, excessive fertilization with other nutrients is not going to eliminate this deficiency but perhaps enhance it. Once he has evaluated this question, then what must be the measuring stick for these constituents? The soil tests or analyses are rapidly establishing this unit of measurement.

When the calcium and magnesium content of the soil has been determined and corrected to compare with a fertile soil, other limiting factors must be investigated. What is the organic matter content, available phosphorus and nitrogen requirement? Finally, it is estimated how the soil compares with one of a certain, maximum, crop-producing power. The available potash must then be estimated, leaching and fixation accounted for, and the crop fertilized for maximum yield.

The influence of 400 lbs. per acre of 0-8-8 upon the yield of early corn on a soil showing a low supply of available phosphorus and potash.

Certain chemical properties of the soil influence the fixation of potash in a difficultly available state. That is, the lower the pH value of a mineral soil low in bases, the higher is the fixation of potash. For example, the Bladen,

Elkton, and Keyport soils have a higher potash-fixing power than the Norfolk, Sassafras, and Craven soils. Therefore, soils of the first group will require higher potash fertilization than soils of the latter group. Since these facts have been established a grower located on the first group of soils must fertilize more heavily with potash for maximum crop production than a grower on the second group.

Nutrient Balance

Likewise, there is the question of nutrient balance in the soil. For example, a soil with a high calcium content will require more potash for adequate potash fertilization than a soil with a low calcium content, but the ultimate yield may be greater. Then there is a point at which it is not profitable to increase one nutrient in the soil over another, lest the plant is unable to get an adequate supply of the nutrient in the lesser amount.

This was well illustrated by a sweet potato experiment reported last year. A small application of potash was not adequate to increase the yield over the no-potash plats whereas large applications greatly increased the yield. Since this study, the influence of magnesium and sodium upon the absorption of potash by plants has been investigated. Large applications of these bases prevented the absorption of potash by the plant, whereas a large application of potash overcame this condition. Since the condition of high sodium and magnesium content in the soil exists only in exceptional cases, it will not be discussed further at this time. However, the nutrient balance in the soil has been shown to be important and deserves consideration in a fertilization program when one hopes to get the most out of his soil.

The author has tried to point out in the above discussion that to adequately investigate a soil fertility program in respect to a particular nutrient, some system of measurement must be set up not only for the nutrient under consideration but for the other factors as well. A system of tests for Coastal Plain soils has been described elsewhere * and need not be mentioned here. The rest of the discussion will relate some of the instances of crop yields under investigation with the growers. It must be admitted that the investigations were not conducted under conditions to produce maximum yields.

First, field experiments conducted in a given section should be designed to ascertain pertinent information for the grower. Second, they should be conducted under conditions as nearly similar to his methods of farming as possible, and yet they should point to a type of fertilization that tends to overcome his shortcomings in fertilization practices. The experiments herein reported were laid out in the grower's field and fertilizer applied in plats of two or three rows each according to randomized blocks so the data could be subjected to statistical analysis.

Instead of considering an ideal situation for investigating the needs of the soil for information regarding potash fertilization, conditions in the average grower's field will be shown.

With the assistance of J. M. Blume a series of fields of different soil types which possessed varying degrees of fertility was located. These differences in the widely varying chemical factors of soil fertility are shown in Table 2. The soils were then fertilized with different fertilizer mixtures, which are given in Table 3. Potato yields on these soils present an interesting picture of certain relations to soil phenomena and potash fertilization.

The soils of the Bayboro, Bladen,

* See Bulletin 95, Virginia Truck Experiment Station.

TABLE 2—CHARACTERISTICS OF VARIOUS SOIL TYPES

Soil Type	pH	Per Cent Organic Matter	Per Cent Total P_2O_5	Per Cent Total Nitrogen	Replaceable Parts per 2,000,000 CaO	Replaceable Parts per 2,000,000 MgO	Replaceable Parts per 2,000,000 K_2O	Fertility Index Short Test P	Fertility Index Short Test K
Bayboro	5.2	6.67	0.13	0.18	2,020	520	67	Poor	Poor
Bladen	5.0	3.84	0.13	0.10	2,130	592	170	Poor	Fair—
Elkton	5.2	3.48	0.16	0.13	2,520	616	160	Poor	Fair—
Keyport	5.05	1.64	0.12	0.06	1,790	592	207	Fair	Fair
Moyock	5.9	2.71	0.23	0.08	3,140	712	179	Fair	Fair—
Sassafras ...	5.5	1.40	0.08	0.07	2,900	1,150	281	Good	Good
Norfolk	5.0	2.63	0.25	0.09	2,460	560	179	Good	Fair—
Norfolk * ...	4.85	1.60	0.16	0.07	740	396	123	V.Poor	Poor

* Limed with 1,000 pounds of hydrated lime.

and Elkton series, while they may not have the lowest replaceable potash content, tend to show the largest response to potash fertilization. It must be realized that while the total replaceable potash content of a soil indicates its available supply of potash, it does not show how much will be absorbed by the plant. Therefore, a correlation of replaceable potash and yields can be expected only on a uniform type, because certain factors regarding physico-chemical relations govern the absorption of potash by plants.

These same factors seem to influence the short chemical tests. For example, as the replaceable potash of a given soil is diminished, the more difficultly available it becomes to the plant. This same relation has been shown with the short chemical test. That is, a Bladen soil with 200 pounds per acre of replaceable potash will give a larger proportion of its potash to the plant, and in the short chemical test, than the same soil with 100 pounds to the acre. Further, it has been shown that a soil with a strong potential acidity (Bladen, Bayboro, Elkton) will retain a larger portion of the replaceable potash against plant absorption and extraction by the short chemical test reagent than a soil with less potential acidity (Norfolk, Sassafras, Craven). The following experiment illustrates this last phenomenon.

A Bayboro silt loam, Elkton silt loam, and a Sassafras sandy loam were placed in a series of tiles. The nutrients, other than potash, were supplied the soil in a constant ratio, and the potash varied from 0 to 800 pounds of K_2O to the acre. The yield of potatoes (Table 4) varied with each increment of potash on the Bayboro and Elkton soils, whereas little difference in yield was noted on the Sassafras soil. The Sassafras soil as well as the Elkton showed a good supply of replaceable potash. Yet there was a

TABLE 3—THE INFLUENCE OF VARIOUS FERTILIZER RATIOS UPON THE YIELD OF POTATOES

Soil Type	Yield in Bushels Per Acre 6-6-0	6-6-5	6-6-10	6-12-10	Bushels Required for Significant Difference
Bayboro	126	188	210	232	12
Bladen	67	130	128	136	18
Elkton	228	268	275	299	41
Keyport	140	190	200	222	50
Moyock	112	147	145	152	20
Sassafras	275	282	300	295	61
Norfolk	140	220	185	213	42
Norfolk	85	141	133	155	29

TABLE 4—THE RELATION BETWEEN POTASH APPLICATION AND THE YIELD OF POTATOES ON THREE SOIL TYPES IN TILE STUDIES

Type of Soil and Replaceable K_2O per Acre	Pounds K_2O Applied per Acre				
	0	100	200	400	800
	(Yield—Bushels per Acre)				
Bayboro silt loam 67 lbs.	181	237	250	316	349
Elkton silt loam 175 lbs.	189	309	396	410	471
Sassafras fine sandy loam 163 lbs.	370	352	357	411	403

difference in response to potash on these two soils. In other words, it requires a higher replaceable potash content in the Elkton soil to produce a crop than it does in the Sassafras. The Elkton soil has a greater potential acidity and thus offers a greater resistance to plant absorption. In this respect the two soils are opposite in phosphate fixation.

Two Potash Problems

In another greenhouse experiment, using the Bladen sandy loam (1.8 per cent organic matter) and the Norfolk fine sand (1.0 per cent organic matter), and growing four crops and leaching four times with rain water, the following relations were shown. The Bladen soil retained 78 per cent of the replaceable and added potash against leaching and 64 per cent against plant absorption. That is, only 22 per cent of the replaceable and added potash was leached by four severe leachings and only 36 per cent was available to four successive crops. Whereas, on the Norfolk soil only 40 per cent of the replaceable and added potash was retained by the soil after leaching and 15 per cent retained against absorption by the four crops. Stating it another way, 60 per cent of the potash was leached and 85 per cent was available to the plants. Consequently, the fertilization of the two soils, in respect to potash, presents two separate and entirely different problems if the most is to be gotten out of the soil.

In order to further point out the relation of potash fertilization and maximum crop yield one more experiment will be cited. In an experiment with spinach on a Sassafras sandy loam of average fertility Mr. Blume compared a 6-6-0 and 6-6-5 fertilizer mixture. With 1,000 pounds per acre of a 6-6-0 mixture the yield was 447 bushels per acre, and with a 6-6-5 mixture it was 540, a difference of 93 bushels per acre. The difference of 50 pounds of K_2O per acre resulted in the increase. Thus, to attain the maximum yield of a crop one must anticipate the maximum yield for the particular soil and fertilize for that yield. It would be needless to fertilize a soil with enough potash to produce 600 bushels of spinach if factors other than potash prevented the growth of 600 bushels.

No discussion of the availability of potash in a soil is complete without a discussion of the different requirements of different plants for potash. For example, certain vegetable crops (potatoes, sweet potatoes, beets, carrots, etc.) have a high potash requirement. These crops not only utilize a large quantity of potash but also remove a large quantity from the soil. Further, it should be mentioned that certain plants have a greater power for getting potash from the soil than other plants. Two different plants may remove an equal amount of potash from a soil yet one would require a higher potash content in the soil. Not much is yet known about these different powers of the various plants.

It is hoped, as time permits, these factors will be investigated.

A series of plats was planned on a Sassafras sandy loam testing low in available potash. Cabbage were planted on this soil and fertilized with 0, 100, and 200 pounds of potash per acre. The no-potash plats produced no marketable crop, and a very large response was noted from 200 pounds of potash over the 100-pound application. Following this crop of cabbage, sorghum was planted and adequately fertilized with nitrogen. The sorghum grew luxuriantly over the whole area. In fact, the potash plats could hardly be found; therefore, the sorghum had a much greater power for extracting potash from this soil. In this manner potash unavailable to cabbage could be made available by the use of a cover crop. In potash fertilization some point between fixation, leaching, and absorption should be selected for a given soil type and used as a guide.

In this discussion the author has tried to point out that the present approach to the fertilization of Coastal Plain soils has given certain definite leads which look extremely interesting. The many gaps yet to be filled in should prove a fruitful field for research and maintain the interest of an inquiring mind.

Vernal Visions

(*From page 5*)

could live again the hours of boyhood with the perspective of maturity, how much more we might do to add a touch of glory to the lives of those we cherish!

And the bumper oats and gigantic corn envisioned by Father in the inglenook of winter fantasy likewise failed somehow to meet his expectations or live up to the pictures issued by the seedsmen. To be sure, he "bit" too often on species ill adapted to the short seasons and weak soils of our paternal acreage. He repeatedly invested in teosinte, lespedeza, kudzu, and such like fancy fragments of forage so that he might "show off" to the neighbors. No doubt he had it coming for unwise selections, but viewing it fairly and after years of seeing efforts wasted by men of greater education and capacity than he, I somehow wish it had been different and that some of his dreams might have been fulfilled just as they looked in the catalogs.

In retrospect I see his naive and ever-youthful zeal of springtime as a sort of sign-manual of the everyday hopes of agriculture all around us. I do not know of any calling followed by mankind wherein the workers come forth again after defeat with renewed and vivified ambitions, wrestling anew in the same old furrows for their share of gladness and light. Wrapped up in its message of confidence is the Easter time, typical of man's faith in himself and the works of nature.

Folks these days who shut themselves in apartment houses with only a few rods of cement before the doorway surely cannot whiff the springtime with the ardor and the fond memories, put into life again, as do others fortunate enough to have a yard to rake and other odd jobs to perform. As I wield the rake amid the litter of winter accumulation, my heart seems as young as it was when our whole family spent April evenings bunching up the late-falling oak leaves and touching them off with matches, if the wind was right. We youngsters danced around the ripping blaze and bashed out the embers with shovels as bedtime drew night. If the breeze

grew gusty we sometimes worked like blackened demons slapping back the flames to keep them from searing the fence posts or creeping through the dry, bottom grass toward the house or barn.

IF SOMEBODY had told me in those days that I would learn to enjoy the chores incident to a spring revival, I would never have believed it. Not that they were hard or difficult in general, but they really took so much time away from the very important things a "feller" had to arrange before the baseball and fishing season began. To some extent I remain that way yet, indifferent to the necessity of cellar cleaning and renovating, patching screen doors, painting screens and removing pesky storm sashes, washing windows, and varnishing the stairs. However, they are not quite so painful to me as they were in my youth, and I have often learned to relish them with the pride of home ownership. I steel myself with the thought that if my wife is able to manage all the spring sewing undaunted, the least I can do is to save on janitor work.

Human doings of spring have somewhat changed since I was assigned sundry stunts in my teens during April vacations. For along with the ancient faith in Doc Jaynes and other almanac soothsayers, certain jobs kindred to the joyful season are on the way to abandonment forever. I refer to parlor stove removal, carpet whacking on the clothes-line, the carting away of foundation packing at the outer walls, and the placement of rain barrels under downspouts at the corners.

I presume here and there we still find folks who spend their winter evenings hugging the cast-iron ornamental heater, with its nickel trim and silver dome—but many farm houses have discarded them for furnaces and stokers.

We had a series of those weighty, awkward, metal monoliths, each one seemingly uglier and heavier than the other. Arising from the rear ran a length of piping that vanished through a register hole in the ceiling and connected there with sundry hot-air reservoirs or drums, and beyond that to lengths of shaky, wire-hung stove pipes in chilly bedrooms above. One had to be careful when tossing a big oak chunk into the heater, lest the vibration loosen some link in the sooty chain and give rise to smoke and fire hazard. The dirt and sawdust fell from those chunks all over the ingrain carpet, and the zinc standard was full of burnt spots. But my folks were raised in the fire-place era, and to them these inconveniences spelt luxury in comparison, although I often argued that one never had to *move* a fireplace in springtime.

THE semi-annual stove tussle was put off as long as possible for two cogent reasons. First, chilly days often sneaked back upon us after we had agreed that spring had "came"; and second, none of us relished the damnable ordeal ahead. We finally said our prayers some pleasant morning and grabbed the crow-bar, the pliers, and our padded cotton gloves. Mother moved all the precious heirlooms aside, so that our pathway to the storage room would leave no chance of serious wreckage.

All the tangled, rusty wires must first be untwisted and the pipe lengths taken outside and beaten free of soot. As a rule most of the soot landed in my hair and Father's whiskers, and on the stairs and floors, so that the pipe-whacking job became a mere formality. When that was over, the lifting and grunting period began, followed rapidly by vehement language unfit for Christians in a peaceful community. My shins and disposition still bear scars of battle endured while quick-stepping backwards with my cheeks pressed against the iron monster and my fingers aching with the horrid pressure of a bottom rim. Invariably one or both of us became lodged in

the narrow doorway, our bellies crushed against some demoniacal protuberance and our eyes bulging with terrifying glares. Father stood it better than I, but he had been through the Civil War and thus had some advantage.

I once proposed after an unusually blasting experience of this kind that the household set up its heater permanently on the lawn and move out there in winter. It would indeed have been almost as effective in warming the house, and the smoke nuisance would have been largely abated. Thank heavens, the kitchen cookstove never migrated!

BEATING rugs gently or giving them an indoor massage a la vacuum cleaners constitutes the bulk of our house-cleaning tasks today. But we followed a sterner system. It was my turn always to "untack" the heavy carpet and roll it up from its dusty bed of year-old newspapers, thence to hoist and stumble with it to the back yard and fling it heavily across the hempen line. Mother gave us a broom and a wire beater, as well as plenty of advice.

When that was done the heaps of strawy manure banked, boarded, and staked around the foundations, as insulation, had to be dug out and spread on the lawn or mixed into the flower beds. When such recreation was insufficient to quash my animal spirits, there were ladders to fetch out and eaves spouts to clean.

Ah, but 'twas not always these rigors of life that met us in the spring. Compensations came early and often, though we did not always recognize them at the time.

There were long walks in marshy dells and damp hollows, the bringing home of the first harbingers of budding life—the pussy-willow catkins, soon followed by white hepaticas and purple pasque flowers. There were visits to Uncle Byron's famous sugar-bush, the lugging in of sap buckets and the fragrance of the sap pans gleaming in the firelight, the dunking of corn bread in luscious syrup, the sweetness and the freshness of old forests in new adornment. There was the gorgeous coloration of the opening white oak buds, equalled only by the pigment of its leaves in the fall. There were the tender greens of the river willows (waiting there for me yet, as I live) down by the old swimming hole not far from the best perch fishing spot in creation. There was the coming home with a stubby stick and a string of crappies, to find that mother had dug up some rhubarb and stewed it down for us into the slickest sauce I have ever sluiced into my gizzard. Or else she was prodding me awake some bright and vernal morning, smiling and telling me that the bluebirds and martins had returned to be our summer neighbors. There was father shyly introducing me to the trick of making a willow whistle, or offering to show me some timber cruising lore he had picked up in the roaring river days of the lumber drives.

Yes, I always liked the spring and I like it still; although the ones who made it happiest for me have ceased to know or care about the seasons or the crops, and have themselves become as resplendent, as joyful and immortal as the springtime world they admired so fondly. But in the faces of my children I see their souls still shining. It makes one cheery to think there are so many things which never die, no matter how hard the winter or how fleeting time can be.

The old man was sitting on the wood pile whittling when his wife came out to hang up the clothes.

"Paw," said the Mrs., "there's a bug crawlin' on you."

The old man went right on with his whittling, without looking up. Presently, he said, "No, Maw . . . it's crawlin' off me!"

FOREIGN ACCENT

A Frenchman, invited to attend a "silver wedding," made inquiry as to what the term meant.

"Oh," answered his host, "that means the couple have lived together for 25 years."

"Ah," exclaimed the Frenchman, enthusiastically, "how charming! And now they are going to get married!"

The professor rapped on his desk and yelled, "Gentlemen, order!"

The entire class shouted: "Beer!"

"Mamma, Pop just ran over Zeb with the drill."

"Heavens! Is he hurt badly?"

"Naw. Zeb told Pop to do it again, 'cause there was a place on his back that still itched."

Oldtime Mosquito (to young mosquito): "And to think that when I was your age I could bite girls only on the face and hands."

WOULDN'T YOU?

School Teacher: "Mickey, which had you rather be, Napoleon or Jack Dempsey?"

Mickey: "Jack Dempsey."

School Teacher: "And why?"

Mickey: " 'Cause he ain't dead yet."

"And what," she asked, "should a little boy say to the lady who has given him a penny for carrying her bundles?"

"I'd hate to tell you," he replied.

Pat: "Moike, why is kissin' your gurril loike a bottle of olives?"

Moike: "Giv it up."

Pat: "Cause ef yez can git one the rest come aisy."

ADJUSTMENT

Mrs. Cohen awoke in the middle of the night to discover her husband pacing wearily up and down the bedroom in his slippers.

"Vo't der matter, Cohen?" she asked him.

"Vell, Rebecca, I owe Isaacs vun hundred pounds, and I haven't a penny to meet it vith. It falls due in der morning."

Mrs. Cohen slipped out of bed, went to the window, threw it open and called, "Mrs. Isaacs! Mrs. Isaacs!"

Over the road a window went up, and a tousled head in curls appeared.

"Mrs. Cohen, vot is der matter? Is dere a fire?"

"No. Cohen owes your husband a hundred pounds, and can't meet it in der morning!"

She shut the window and turned to her husband.

"Come back to bed, Cohen, and let Isaacs pace der floor!"

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